

QT
B92p
1884

PRACTICAL WORK
IN
THE SCHOOL ROOM
—
PART I.
—
THE HUMAN BODY

QT B92p 1884

61250250R



NLM 05046176 6

NATIONAL LIBRARY OF MEDICINE

SURGEON GENERAL'S OFFICE
LIBRARY

ANNEX

ANNEX

Section -----

Form 113c
W. D., S. G. O.

No.

292826

GOVERNMENT PRINTING OFFICE

SEP 2 1884

15577 P

Buckelew, Sarah Frances
111

PRACTICAL WORK
IN THE
SCHOOL ROOM.

Part I.

A TRANSCRIPT

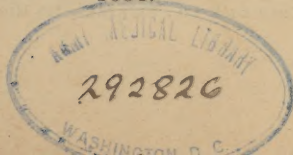
OF THE
OBJECT LESSONS ON THE HUMAN BODY

GIVEN IN PRIMARY DEPARTMENT,
GRAMMAR SCHOOL No. 49,
NEW YORK CITY.



NEW YORK:
A. LOVELL & COMPANY.

1884.



QT

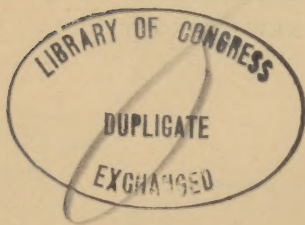
B92p

1884

Entered, according to Act of Congress, in the year 1884, by

SARAH F. BUCKELEW AND MARGARET W. LEWIS,

in the Office of the Librarian of Congress at Washington.



NOTES TO THE TEACHER.

I. Children should learn these lessons on the Human Body, that they may better value and take care of "the house they live in." *Each lesson should be very carefully developed when taught.* No intelligent teacher will permit the recitation of the formulas to degenerate into rote-work. Children are not parrots.

II. The following plan has been observed in the preparation of this work :—

First, *A model lesson*, as given in our own class-rooms, to show how each subject should be developed and taught.

Second, *A formula*, embodying the principal facts, etc., given during the development and teaching.

Third, *Questions for the formula*, intended to aid in concert or individual recitation of the summaries it contains.

Fourth, *Directions for touching*. These are given very minutely, because we think appropriate touching, or pointing to the part under description, when convenient, adds much interest to the recitation ; it makes the facts seem more real to the children.

Fifth, *Questions on the lesson*, designed to recall instructions, given during its development, which may or may not be found in the formula.

These questions are important ; therefore, do not omit them. Use them frequently. The pupils may reply in their own words if this method is deemed preferable.

Lastly, *A blackboard outline*, which may be used with advantage in review lessons.

III. In the recitation of the formulas : —

Be careful about the wording of the Questions for the Formulas.

Do not permit sing-song.

Be careful about the touching of the parts.

Use the required apparatus, charts, etc., in developing and reviewing.

Do not review by rote. Take time for explanations, for criticism of tone, pronunciation, etc., when necessary.

Remember, "What is worth doing at all is worth doing well," especially in teaching.

TABLE OF CONTENTS.

	PAGE.
NOTES TO TEACHERS	iii
PLAN OF LESSONS	viii
PART I.—INTRODUCTORY LESSONS.	1
“ II.—THE LIMBS	18
“ III.—THE BONES OF THE BODY	31
“ IV.—THE ORGANS OF SENSE	39
“ V.—THE DESCRIPTION OF THE BONES	55
“ VI.—THE MUSCLES	65
“ VII.—THE SKIN	73
“ VIII.—THE HEART AND THE CIRCULATION	81
“ IX.—THE LUNGS AND RESPIRATION	89
“ X.—THE DIGESTIVE ORGANS	97
“ XI.—THE NERVOUS SYSTEM	109

APPENDIX I.

THE STORY ABOUT ALCOHOL	121
USES OF ALCOHOL	122
USES OF ALCOHOL — <i>concluded</i>	123
ABOUT FERMENTATION	125
DISTILLATION	127
HARM DONE BY ALCOHOL	129
STORIES ABOUT HARM DONE BY ALCOHOL	140
STORIES ABOUT THE RIGHT WAY TO TREAT ALE, ETC.	144

APPENDIX II.

INTRODUCTORY LESSON	149
THE STORY ABOUT TOBACCO	150
THE POISON IN TOBACCO AND THE HARM IT DOES	152
OPIMUM AND OTHER NARCOTICS	157

THE HUMAN BODY.

		Sixth or Alphabet Grade.	Fifth Grade.	Fourth Grade.
1st Month.	1st Week	Touch and name parts of the <i>head</i> and <i>face</i> .	Review 6th Grade formula and questions.	Rev. formula and questions of 6th and 5th Grades.
	2d "	Touch and name parts of the <i>head</i> and <i>face</i> , with formula.	Touch and name the <i>limbs</i> , with formula.	Rev. formula and questions of 6th and 5th Grades.
	3d "	Touch and name parts of the <i>trunk</i> and <i>limbs</i> .	Touch the <i>parts</i> and <i>joints</i> of the <i>arm</i> , with formula.	Teach about the <i>eye</i> .
	4th "	Touch and name parts of the <i>trunk</i> and <i>limbs</i> , with formula.	Touch the <i>parts</i> and <i>joints</i> of the <i>head</i> , with formula.	Rev., with formula.
2d Month.	1st Week	Develop Section 3.	Touch the <i>parts</i> and <i>joints</i> of the <i>leg</i> , with formula.	Rev., with formula and questions.
	2d "	Review Section 3, with formula.	Touch the <i>parts</i> and <i>joints</i> of the <i>foot</i> , with formula.	Rev., with formula and questions.
	3d "	Review Section 3, with formula. Ten questions.	Rev. Eleven questions.	Teach about the <i>ear</i> .
	4th "	Review Section 3, with formula. Three questions.	Review.	Rev., with formula.
3d Month.	1st Week	Review Section 3, with formula. Eight questions.	Teach the bones of the <i>head</i> and <i>limbs</i> .	Rev., with formula and questions.
	2d "	Develop Section 2.	Teach the bones of the <i>arm</i> and <i>hand</i> .	Teach about the <i>nose</i> .
	3d "	Review Section 2, with formula.	Teach the bones of the <i>leg</i> and <i>foot</i> .	Rev., with formulas and questions.
	4th "	Review Section 2, with formula. Two questions.	Rev. Eleven questions.	Teach about the <i>mouth</i> .
4th Month.	1st Week	Review Section 2, with formula. Five questions.	Rev. Eleven questions.	Rev., with formulas and questions.
	2d "	Develop Section 1.	Rev. Eleven questions.	Teach about the <i>teeth</i> , etc.
	3d "	Review Section 1, with formula.	Teach advanced lesson on the <i>joints</i> .	Rev., with formulas and questions.
	4th "	Review Section 1, with formula. Six questions.	Rev. Seven questions.	Review.
5th Month.	1st Week	Review.	Review.	Review.
	2d "			
	3d "			
	4th "			

		Third Grade.	Second Grade.	First Grade.
1st Month.	1st Week	Rev. formulas and questions of previous Grades.	Rev. formulas and questions of previous Grades.	Rev. formulas and questions of previous Grades.
	2d "	Rev. formulas and questions of previous Grades.	Rev. formulas and questions of previous Grades.	Rev. formulas and questions of previous Grades.
	3d "	Rev. formulas and questions of previous Grades.	Rev. formulas and questions of previous Grades.	Rev. formulas and questions of previous Grades.
	4th "	Rev. formulas and questions of previous Grades.	Rev. formulas and questions of previous Grades.	Rev. formulas and questions of previous Grades.
2d Month.	1st Week	Teach Part V.	Teach Part VIII.	Teach Part X.
	2d "	Teach Part V.	Teach Part VIII., with formula.	Teach Part X., with formula.
	3d "	Rev. Part V., with formula and questions.	Teach Part VIII., with formula.	Teach Part X., with formula.
	4th "	Rev. Part V., with formula and questions.	Review Part VIII., with formula and questions.	Rev. Part X., with formula and questions.
3d Month.	1st Week	Teach Part VI.	Review Part VIII., with formula and questions.	Rev. Part X., with formula and questions.
	2d "	Teach Part VI.	Review Part VIII., with formula and questions.	Teach Part XI.
	3d "	Rev. Part VI., with formula and questions.	Teach Part IX.	Teach Part XI., with formula.
	4th "	Rev. Part VI., with formula and questions.	Teach Part IX., with formula.	Teach Part XI., with formula.
4th Month.	1st Week	Teach Part VII.	Teach Part IX., with formula.	Rev. Part XI., with formula and questions.
	2d "	Teach Part VII.	Review Part IX., with formula and questions.	Rev. Part XI., with formula and questions.
	3d "	Rev. Part VII., with formula and questions.	Review Part IX., with formula and questions.	Review.
	4th "	Rev. Part VII., with formula and questions.	Review Part IX., with formula and questions.	Review.
5th Month.	1st Week	Review.	Review.	Review.
	2d "			
	3d "			
	4th "			

PART I.

INTRODUCTORY LESSONS.

1. *The Parts of the Body.* — We touch the various parts of the head, the children naming what is touched; then the class touches and names the same parts according to the formula. The remaining parts of the body are touched and named in the same way, until all are familiar with the name and position of each part. In Review Lessons, the children use the formula.

2. *The Head, Trunk, and Limbs.* — We show two jointed wooden dolls; take off the head, arms, and legs of one, and then ask the name of its remaining part, “the body.” What do you call the large part of a tree which rises out of the ground above the root? — “The stem, the trunk.” We give the name *trunk* to that part which you have just called “the body,” that is, to all the body except the head, arms, and legs. When we speak about the body, we mean the whole body, from the top of the head to the sole of the foot. You may tell what we mean by the trunk of the body. — “All the body except the head, arms, and legs.” Of what other trunk do you know, beside the trunk of the body? — “A trunk to put clothes in.” Of what are such trunks made? — “Of wood, covered with paper; of wood, covered with leather.” Of what is the trunk of the body made? — “Of bones, flesh, and skin.” For what do you use the wooden trunks? — “To put clothes in.” What is in the trunk of the body? — The children do not know, so we explain that the heart, the lungs, and stomach are inside the body.

We talk about the trunk of a tree; make on the blackboard a sketch of one, with its branches, and ask what the latter are called. — “Sticks of the tree, branches, limbs of the tree.” We bid a child take the unbroken doll and point to its trunk, then stretch out its arms and legs. The children perceive that the arms and legs extend from the trunk of the body as the limbs from a tree, and give the term *limbs* to these parts; they also discover, by counting, that the body has four limbs fastened to its trunk.

What has the doll's body beside the trunk and limbs? — “A head.” Name the parts of the doll's body. — “Head, trunk, limbs.” Touch and name the parts of your own body. — “The head, the trunk, the limbs.” Lastly, we teach the children to say, “The parts of the body are the head, the trunk, the limbs.”

3. *The Bones, Flesh, and Skin.*—Those who have seen men building houses may raise the hand. Of what do they build houses? — “Of wood, of stone, of bricks.” For what do they build houses? — “For people to live in.” How many of you would like a house of your own? Hands are raised in reply, and the children are told that they do possess a house of their own, not made of wood or stone, but very wonderful, because it can move from place to place; that they live in it all the time, wherever they are. Soon some bright little thinker discovers that we mean the body, and when we ask, Who lives in your body? answers with an air of conscious ownership, “Myself.”

If a picture of a frame house in process of building can be obtained, it is shown and talked about; then we ask, Of what is your body-house built? — “Of bones, flesh, and skin.”

We next call upon some child to tell about the body, and receive in reply the sentence, “My body is built of bones;” this statement is repeated by the class.

We tell the pupils that we intend to print what they have said on the blackboard. We ask for the first word, “My”:

when printed, they read it. Thus each successive word is given and read by the children until the sentence is completed.

Other questions lead them to give the additional clause, "covered with flesh and skin," which is also printed and read. The entire sentence is read and memorized by the class. "My body is built of bones covered with flesh and skin."

Do we expect our abecedarians will learn to spell each of the words and recognize them readily at sight? No; some may do so, but our object, in this blackboard work, is not to teach spelling or reading. We only desire to awaken more intense interest, and assist the memory of the children to receive the formulas we wish them to remember; for, while opposed to parrot-like repetition, we are equally averse to pursuing the other extreme, which allows the memory to weaken by inaction lest it be overburdened. We firmly believe this faculty is strengthened by use, and should be trained to work daily. So we give our scholars definitions and formulas to memorize, as occasion requires.

4. *The Use of Food.*—Those who ate breakfast this morning may raise the hand. Well, what did you have for breakfast?—"Meat, coffee, bread, etc." How did you eat your food? Did you put your head down to the plate and take your meat dog-fashion? Amused at the allusion, they promptly answer, "We took it up with a fork." Did you put all the large piece of meat into your mouth at once?—"No, we cut it into little pieces with a knife." How did you carry it to your mouth?—"With a fork." When it was in the mouth, what did you do with it?—"We chewed it." What then?—"We swallowed it." What then?—"We did not do anything else with it."

True, when you have swallowed your food you can do nothing else with it, but that is not the last of what you have eaten; without your help it passes through some wonderful changes, after going down your food-pipe, which leads from your mouth to a strangely-shaped bag of flesh called the stomach. Here we exhibit a chart representing the Digestive Organs, or draw

an outline showing the parts named. Then we call upon one of the children to describe the journey of the food from the plate to the stomach.

We next tell them that the little food-ball rolled from the mouth into the stomach does not rest in that fleshy bag, but is changed by a juice which the stomach pours upon it,—a wonderful kind of juice which can melt meat, bread, apples, or anything good to eat; that the stomach presses upon the food and pushes it along, changing it so much that if there were a little door through which they could look into the stomach, and they were to peep through it, soon after the food had been swallowed, they would find it impossible to decide which was meat, or apples, or bread, etc.

Lastly, we explain that the melted and mixed food passes out from the stomach, and, by and by, is changed into blood; that the blood goes through the body and makes bones, flesh, skin, hair, and nails.

But why this talk about the process of digestion and the use of the blood? Because we wish to teach the little folks as early as possible why they eat, why they should masticate their food thoroughly, and why they should avoid improper food and drink.

5. Against Alcoholic Liquors.—We also explain that what we drink goes into the stomach, and, if not poisonous, helps to make good blood. We let the class mention different kinds of drinks, and place the names given upon the blackboard, thus :—

1.	2.	3.	4.
Water.	Tea.	Root-beer.	Wine.
Milk.	Coffee.	Soda-water.	Cider.
	Chocolate.	Lemonade.	Beer.
	Cocoa.	Ice-water.	Brandy, etc.

When these lists have been prepared, we let the children several times repeat the names they contain, as we point to each column respectively: then we talk about pure cold water.

Water, the drink which God has made for people and animals ; which is so delicious and refreshing to us when we are thirsty ; the only drink which the birds, fishes, and beasts use ; which helps to keep them alive, and strong, and healthy.

Next, we refer to milk, which most children like to drink, and which is so healthful and pleasant as a kind of food.

Thirdly, we talk about the tea, coffee, etc., named in the second column, and caution against drinking too much, if any, of these beverages. We lead the children to notice that water forms the greater part of all these favorite drinks, as it does also of those mentioned in the third column of our list.

The pupils know that lemonade and soda-water “taste good,” but will not do to drink every day ; they like ice-water, but we warn them that it must be used sparingly, and never when they are very warm.

Lastly, we talk about rum, brandy, whiskey, etc., and teach about the terrible foe to health, goodness, and happiness which is hidden in these liquors, — viz., **ALCOHOL**.

The healthy stomach is glad to get bread, meat, potatoes, water, etc., which help to make good blood ; but when anything enters it which contains alcohol, it tries to get rid of it right away, and hurries it into the liver, which lies under the lungs, on the right of the stomach.

Some of the alcohol passes from the liver through the heart into the lungs, and the lungs send it out through the nose and mouth so quickly, that very soon after any one has taken even a small quantity of the poison, the breath tells the story, and we know they have been drinking something stronger than water.

But all the alcohol does not come out thus easily. Some stays in the blood, and goes with it through the arteries and veins, doing much mischief and no real good as it passes through the body. It makes believe keep the body warm, but really makes it colder than it should be ; it makes the stomach sore ; it takes some of the goodness out of the blood ; it makes the heart work hard in beating too fast ; it reddens the face, and

makes the nose a bad color; it takes the bright, good look out of the eyes, and makes them too red. But it does the most mischief to the head. It makes it ache; makes it unfit to think; and when people drink much of any vile stuff which has alcohol in it, they lose their good sense and goodness, and often do very terrible and wicked deeds.

The children have seen drunkards, and all know how strangely these act; but perhaps they think that only those who drink rum, whiskey, brandy, or gin get drunk. We teach them that the same serpent of evil is found in all kinds of wines, beer, lager beer, ale, and cider; so that the only way to be safe from it, is not to drink anything which has *fire-water* or alcohol in it. We explain that alcohol is made from the juice of rotten fruits, grains, or vegetables, and is found in gooseberry, blackberry, or any other home-made wine as well as in the liquors sold in the grog-shop. Even root beer and cider, if left long enough, will get full of alcohol.

So let all alcoholic drinks alone, for the only good part of them is the water they contain, which is best to quench the thirst and keep us healthy.



INTRODUCTORY LESSONS — *continued*.

6. *The Blood and the Heart.* — If you cut your foot, what will flow from it? — “Blood.” If you prick your finger, what will flow out? — “Blood.” Where does the blood come from? Some think from the head, none can tell correctly; so we direct them to imitate our movements, as we place our hand upon the chest, near the breastbone, toward the left side. What do you feel? — “Something moving, something shaking.” What is it that is moving? Usually some one replies, “The heart”; if not, we tell them, and give them the word *beating* for *moving*, to describe its action; then we explain that the heart acts like a pump, sending the blood to different parts of the body. When we again ask, Where does the blood flow from? the children promptly reply, “From the heart.”

Again we let them notice the beating of the heart, and bid them show with the hand how it beats, which they do by moving the right hand back and forth, keeping time with the motion of the heart; we also inform them that the heart pumps out blood at every beat. When do you think the heart beats?—"All the time." Does your heart beat when you are asleep? They think it does not; so we ask, How many of you have seen a baby asleep? Did its heart beat while it slept? If they do not know, we advise them, when they see a baby or a person asleep, to walk on tiptoe, place the hand very gently over the heart of the sleeper, and notice whether it beats or not.

Although they cannot tell decidedly whether the heart beats during sleep, yet they answer promptly "We die," if asked, What happens when the heart stops beating? Do you die when you go to sleep? They know they do not; so readily infer that the heart beats all the time, whether we are awake or asleep.

We show or talk to them about a watch, let them see its hands move, and listen to its ticking. What happens when the watch stops ticking?—"The hands stop moving; the hands will not move." If the heart stops beating, can people move their hands or any part of the body?—"They cannot." What is done to keep the watch ticking?—"Somebody winds it." What do they wind the watch with?—"With a watch-key." How often should a watch be wound to keep it going?—"Every day." Does anyone wind your heart every day to keep it going? They laughingly reply, "No." We quiet their mirth, and ask, But who does keep our heart beating? With reverent tone, they tell us "God"; and we speak of the goodness of God, who made our wonderful bodies, made our hearts beat, and keeps them beating every day without our help; of His great wisdom in giving us hearts which go on beating, sometimes for a hundred years, without stopping to rest. These thoughts of God, as our Creator and Preserver, are naturally suggested, and not soon forgotten by the interested listeners.

Next, we pour water from a glass, and explain that when we

wish to speak of water moving, we say, Water flows. The children readily understand that blood moves like water, and tell us "Blood flows." We print these words as in the first lesson. Where does the blood flow?—"Through the body." This answer is placed upon the board, and the children repeat the five words, "Blood flows through the body." We show that we can say this in four words, by using a little word of two letters, *it*, if we do not want to say, *the body*; we then change the sentence to "Blood flows through it."

You say the heart beats all the time, and we have told you that blood flows from it every time it beats; then when does the blood flow through the heart?—"All the time." Where does the blood flow from?—"From my heart." This clause completes the second part of the formula which is memorized by the class. The children are taught to place the right hand over the heart when they repeat the word *heart*.

What do you see on the back of the hand beneath the skin? "Blue marks, lines, veins," are the usual replies. What have you seen in the garden that looks something like the veins in shape?—"The sticks of a tree; the branches of a tree." Where are the veins?—"On the back of my hand." We explain that the veins are in every part of the body. How many of you have seen water pipes? When water is thrown into the sink, where does it go?—"Down the water pipes." What kind of pipes carry away the dirty water?—"Waste pipes." Look at the veins on your hands and wrists. In your body you have good blood and bad blood; the bad blood flows through the veins; some of these you can see because they are so near the surface of the skin. What kind of blood is in the veins?—"Bad blood." What are the veins?—"Pipes." Pipes for what?—"Pipes for the bad blood to pass through." What kind of blood is in the body beside good blood?—"Bad blood."

Do you think that it would be well for the good blood to pass through the same pipes as the bad blood? Why not?—"It would be made bad." There are other pipes which carry the good blood through the body; these are called *arteries*. These



A, the heart ; B, the lungs ; light cross lines, arteries ;
heavy lines, veins.

pipes are stronger than the veins, because the good blood in them comes directly from the heart, and moves as fast as the heart beats; if the arteries were not very strong, they would burst, and then the heart-pump would soon be emptied of blood; they are placed deep below the surface of the body, to keep them from getting hurt; for, when an artery is cut, the good blood flows out so fast we should soon bleed to death, if no one were near to tie up the artery, so that the blood could not come out, or spurt out, as we say when we talk about the way the blood flows from the arteries.

Lay the finger of your left hand on your right wrist. What do you feel?—“Something moving.” Who sometimes puts his finger on your wrist when you are ill?—“The doctor.” Why does he place his hand on your wrist?—“To find how sick I am; to find my pulse.” The last answer is usually given by some child; if not, we tell about the pulse, giving its name, as we explain that it is a large artery in the wrist, so near the surface that we can easily feel its beatings; that it beats as fast as the heart, and helps the doctor to find out how fast the heart beats, when he places his finger on the wrist, although he does not touch the heart. Put your hand on your temples; what do you feel?—“Something beating.” That something is an artery, and you will feel another if you place your finger on the side of your head, in front of the upper part of your ear.

Touch the artery in your wrist; the arteries of your temples; the arteries near the ears. What kind of blood is in the arteries?—“Good blood.” Grown people use the word *pure* for *good*, so what may you call the good blood?—“Pure blood.” What carries the good or pure blood through the body?—“The arteries.” What are the arteries?—“Pipes for the good blood to pass through.” What carries the bad blood through the body?—“The veins.” What kind of blood is in the veins?—“Bad blood.” Grown people call the *bad* blood *impure* blood. What do you call bad blood?—“Impure blood.” What do you mean by impure?—“Bad.” Then what do you mean by impure blood?—“Bad blood.”

We explain that the good blood passes through the arteries to every part of the body, giving to each part something to make it grow. For instance, some of the blood goes to the arm and hand: as it passes along it gives something to the bones to make them grow; something to the flesh to make it grow; something to the skin to make it grow. In the fingers it gives something to the nails to make them grow. Then what does the blood make in the body? — “Bones, flesh, skin, hair, and nails.”

In making bones, flesh, skin, hair, and nails the blood becomes very poor, because it has given away its goodness, so it is not fit to make the body grow and keep it alive; it also becomes bad or impure. Raise your hands, move them; you have worn out some parts of your hands and arms in moving them. When you move any part of your body you wear out some of its particles, or little parts finer than the chalk dust which you can take up with your fingers.

These fine little parts of bones, flesh, and skin, which are worn out, are dead, and of no use to the body, so the blood helps to carry them away; this makes the blood dark and thick; the blood has also given away its goodness to make bones, flesh, hair, skin, and nails; it is no longer bright and good blood, so it goes into the veins, where it moves more slowly than it did in the arteries; it goes through the veins to the right side of the heart, but the heart does not want bad blood, so it sends it to the lungs to be made good. In the next lesson we will tell you what makes the bad blood good in the lungs.

A chart representing the Circulatory Organs is generally shown to the class during these explanations of the heart, arteries, and veins, but the lessons can be given without this aid.

INTRODUCTORY LESSONS — *concluded*.

6. *The Air and its Use.*—Put your hand before your mouth: what do you feel?—“Wind, breath.” How does it feel?—“Hot.” Where does it come from?—“From the nose; from the mouth.” We here explain more fully about the lungs, letting the children cross their hands on their chest, to feel the motion produced in this part of the body, as they draw a deep breath and suddenly let it out of the mouth and nose.

To give them the idea of air, we ask, Why do we open the windows in our class-room?—“For the wind to come in.” We tell them that what they call wind is air moving. How does the air come into the room?—“It blows in.” By referring to the word used to tell how water moves, they soon learn to say, “Air flows.”

Where is the air?—“Out doors.” Where else? Finding them ignorant of the presence of air in the room, we direct them to move their hands rapidly, or to fan with their aprons; thus they quickly perceive that wind, or air, is in the room. We show them two boxes, one filled, the other empty. What is in this empty box?—“Nothing.” Nothing which you can see, but there is air in it. We fill a glass with water; then explain that the air must go out as the water is poured into the tumbler. We empty the glass and ask, What has taken the place of the water?—“The air.” Thus they obtain the idea that air fills all vacant places, and give the correct answer, “Everywhere.” when we ask, Where is the air?

To teach them that air is easily moved, we let them stir water in a glass or pail, which shows that this fluid is easily moved; then we let them move through the air, rising, sitting, or walking, according as we signal. They are pleased to learn that they move the air when they walk or run, and that birds move it when they fly, as really as the fishes move the water when they swim.

How many of you have seen a river? What is in a river? What can you tell about the water of a river?—“It moves.”

When does it move?—“All the time.” Just so the air is always moving, although you cannot see it as you can the water in a brook or river. Fishes swim about in the water which is always moving, so people walk and move about in the great ocean of air which is always moving around them. When do you feel the air move?—“When the wind blows hard; when I fan myself; when I move very fast; when any one moves fast where I am.” What have you learned about where the air is?—“Air is everywhere.” What have you learned about the way air moves?—“It moves easily; it moves all the time.”

The presence of the air, its easy and constant motion, and the word employed to express the motion having been taught, they readily understand that the ever-moving air which they cannot see flows through the open doors of the nose, and enters the back of the mouth.

We next tell them of the windpipe, with its little trap-door to keep food or drink from entering the lungs; that the lungs are the parts into which the heart sends the bad blood, and into which the air goes to make the bad blood bright, red, good blood; that the air is made bad or impure while it is doing this work for the blood, and that the lungs send it out through the wind-pipe, the nose, and the mouth; that the bad air mixes with the air around us and makes it impure, so we must open the windows and doors for ventilation, and take recesses, that the air in the room may be well purified.

What do you breathe through?—“My nose and mouth.” “I breathe through my nose and mouth” is printed on the board. Into what do you take the air?—“Into my lungs.” “And take the air into my lungs” completes this portion of the formula, which is repeated by the children, who touch the nose and mouth with the right hand, and cross the hand upon the chest over the lungs, as nose, mouth, and lungs are mentioned.

In the last lesson, you learned that the heart sends the bad blood to the lungs. What makes the bad blood good in the lungs?—“The air.” Yes, the air gives the blood something to

make it pure ; the lungs send it back to the heart : then the heart sends the good blood to the different parts of the body.

7. *Against Tobacco.*—The children have been taught the injurious effects resulting from drinking alcoholic liquors ; they are now ready to understand what we teach about tobacco poison.

They recognize the tobacco, snuff, cigars, and cigarettes which we show, for many of them are but too familiar with the use made of these vile articles.

If they do not already know, they are taught from what tobacco is obtained, and how it came to be used by civilized people ; of the poison it contains, and what harm it does to all who chew, snuff, or smoke, especially if they are children. See teachings about Tobacco in the Appendix.

At the conclusion of these lessons, the children are ready to give intelligent answers to the questions of this grade. Afterward, we teach them the words we have chosen them to use in their replies, and, by frequent repetitions of the questions, help them not only to remember, but to be prompt and accurate, when examined concerning the facts they have learned.

FORMULA FOR INTRODUCTORY LESSONS.

1. My body is built of bones covered with flesh and skin ; the blood flows through it, all the time, from the heart. I breathe through my nose and mouth, and take the air into the lungs.

2. The parts of my body are the head, the trunk, the limbs.

3. My head.	My nose.	My two hands.
The crown of my head.	My two cheeks.	My trunk.
The back of my head.	My mouth.	My back.
The sides of my head.	My chin.	My two sides.
My face.	My two ears.	My chest.
My forehead.	My neck.	My two legs.
My two temples.	My two shoulders.	My two knees.
My two eyes.	My two arms.	My two feet.

I am sitting erect.

QUESTIONS FOR THE FORMULA.

1. Tell about your body.
2. Name and touch the parts of the body.
3. Name and touch the parts of the head, trunk, and limbs.

DIRECTIONS FOR TOUCHING.

The teacher always touches with the hand opposite to that which the children are required to use.

The right hand of each child is placed over the *heart*, as the latter is mentioned; also upon the *nose* and *mouth*, as these are named.

The hands are crossed over the *lungs*.

Both hands are used to touch the *head*, *trunk*, and *limbs*; also to touch each part of these members, as it is mentioned.

N.B. — Section 1 of Formula begins with "My head, the crown of my head, etc." Section 2 with "The parts of my body, etc." Section 3, "My body is built of bones." Section 4, "I breathe through, etc." In review recitations, these sections are recited in the order given in the Formula for Introductory Lessons.

QUESTIONS ON THE INTRODUCTORY LESSONS.

Of what is the body built? — "Of bones."

What covers the bones? — "Flesh."

What covers the flesh? — "Skin."

What flows through the body? — "Blood."

Where does the blood flow from? — "The heart."

When does the blood flow from the heart? — "Every time the heart beats."

Show with your hand how the heart beats.

When does the heart beat? — "All the time."

What happens when the heart stops beating? — "We die."

What do you see on the back of your hand, beneath the skin? — "Veins."

What is in the veins? — "Bad blood."

What are the veins? — "Pipes for the bad blood to pass through."

Where do the veins carry the bad blood? — "To the lungs."

What happens to the bad blood when it is in the lungs? — "It is made pure."

What makes the bad blood pure? — "The air."

How does the air get into the lungs? — "Through my nose, mouth, and windpipe."

What is breathing? — "Letting the air into and out of my lungs, through my nose, mouth, and windpipe."

When do you breathe? — "All the time."

What do you breathe? — "Air."

What do you breathe through? — "My nose, mouth, and windpipe."

Where do you get the air? — "Everywhere."

Where do the lungs send the pure blood? — "To the heart."

Where does the heart send the pure blood? — "All through the body."

How does the heart send the pure blood through the body? — "Through pipes called arteries."

What kind of blood passes through the arteries? — "Pure blood."

What kind of blood passes through veins? — "Impure blood."

What carries the pure blood through the body? — "The arteries."

What carries the impure blood through the body? — "The veins."

What makes blood? — "Food and drink."

What is food? — "Anything good to eat."

What is drink? — "Anything good to drink."

Name some kinds of wholesome food. — "Meat, potatoes, oranges, apples, etc."

Name some kinds of wholesome drink. — "Water, milk, lemonade, etc."

What do you mean by wholesome food? — "Food that will make good blood."

What do you mean by wholesome drink? — "Drink that will make good blood."

What does the blood make? — "Bones, flesh, skin, hair, nails, and cartilage."*

What use is the blood to the body? — "It makes the body grow, and keeps it alive."

Name some kinds of poisonous drinks. — "Rum, brandy, ale, cider, etc."

What do you mean by poisonous drinks? — "Drinks which hurt or poison the body."

Why do you say that rum and the other drinks you have named are poisonous? — "Because they do harm to every part of the body."

Which part do they hurt most? — "The head or brain."

What harm do they do to the brain? — "They make it unfit to do its work."

What work does the brain do? — "Thinking."

Then what harm do rum, brandy, wine, and these other drinks do to the brain? — "They make it unfit to think."

What other poison do some people use? — "Tobacco."

When do children use tobacco? — "When they chew tobacco; when they smoke cigars or cigarettes."

How much does tobacco poison hurt children? — "More than it hurts any-body else."

In what way does it hurt children? — "It keeps children from growing fast; from being strong and healthy; and from learning as well as they ought."

How does it do all this mischief to children? — "It poisons their lungs, their heart and blood, and their brain."

* Cartilage is not mentioned in the Introductory Grade.

BLACKBOARD OUTLINE.

1. THE BODY.

BUILT OF:	HAS:	ITS PARTS:
Bones;	A heart;	The head;
Flesh;	Two lungs,	The trunk;
Skin.	Red blood.	The limbs.

2. THE PARTS.

OF THE HEAD:	OF THE TRUNK:	OF THE LIMBS:
The crown of the head;	The neck;	The two shoulders;
The back of the head;	The throat;	The two arms;
The sides of the head;	The back;	The two hands;
The face; the two temples;	The two sides;	The two legs;
The two eyes; the nose;	The chest.	The two knees;
The two cheeks; the mouth;		The two feet.
The chin; the two ears.		

PART II.

THE LIMBS.

THE development of this section proceeds somewhat as follows: The children are asked, How many limbs have you? — “Four.” Which are your limbs? — “My arms and legs.” How many arms and legs have you? — “Two.” Then what may you say are your limbs? — “My limbs are my two arms and my two legs.”

1. *The Arm and its Parts.* — The attention of the class is directed to a jointed doll, and asked, Why do you like a jointed doll? — “Because it can be bent; because its arms and legs can be bent.” — How many pieces or parts has the doll’s arm? — “Two.” How many parts has your own arm? — “Two parts.” What may you say about your arm when asked about its parts? — “My arm has two parts.” What would you name the part near the shoulder? — “The top arm.” What do you call the top story of a house? — “The upper story.” Why do you call it the upper story? — “Because it is up stairs.” Yes, upper means up; what may you call your top arm? — “The upper arm.” Why do you call it the upper arm? — “Because it is at the top part of the arm.” If the top part of the arm is called the upper arm, what may you call the other part of the arm? — “The lower arm.” We bid the children bend the right arm at the elbow, and move it backward and forward in front of the chest; then lead them to notice that this part of the arm is always in front, never turned backward at the elbow joint, so it is named “forearm,” which means the arm in front of the upper arm.

How many parts did you say your arm has?—"My arm has two parts." This statement is printed upon the board. You may touch the parts of your right arm with your left hand, and name each part as you touch it.—"My upper arm, my forearm." This clause is added to the one already printed, and completes the portion of the formula: "My arm has two parts: my upper arm, my forearm."

Tell again why you like a jointed doll?—"Because its arms and legs may be bent." In how many places may the arm of the doll be bent?—"In two places." Where are these places?—"At the shoulder and the elbow." What do you call these places where the arm may be bent?—"Joints." If the class cannot give the term "joints," we ask what name is given to the place where two pieces of wood are joined together, and usually receive the desired answer,—"A joint." Then what may you call the place where two parts of the arm are joined together?—"A joint." Where are the upper arm and the forearm joined?—"At the elbow." What name will you give to the joint at the elbow?—"Elbow joint."

Where is the upper arm joined to the trunk?—"At the shoulder." What name will you give to the joint at the shoulder?—"Shoulder joint." How many joints has the doll's arm?—"Two joints." Name them, beginning at the top joint.—"The shoulder joint, the elbow joint." What may be done with the arm at these joints?—"It may be bent." Of what use are the joints of the arm?—"To bend the arm." How many of you would like an arm without any bending places? Not any one! Why not?—"It could not be bent."

Hold your arm out without bending it at the elbow; raise it above your head; touch the top of your head without bending your wrist or elbow. These experiments help the children to realize how useless an arm with no joints (that is, an arm having only one part) would be to them, and make them feel that even the joints of their arms are something for which to be thankful to God their Creator.

What may you do with your arm at the joints?—"Bend it."

What are these joints?—“Places where we bend the arm: bending places.” How many joints or bending places has the doll’s arm?—“Two.” How many has your own arm? The children look at their own arms and tell us, “Three.” How many more joints has your arm than the arm of the doll?—“One more.” Where is the joint on your arm which is not on the doll’s arm?—“At the wrist.” What name will you give to this joint?—“Wrist joint.” What may you say about your arm when you tell about the number of its joints?—“My arm has three joints.” This statement is printed upon the board.

Touch the joints of your right arm with the fingers of your left hand, beginning at the top joint, and name each joint as you touch it. The children give the names, which are added to the words already printed. You may read from the board what you have told about your arm.—“My arm has two parts: my upper arm, my forearm; and three joints: my shoulder joint, my elbow joint, my wrist joint.” Again we show the class how to touch when the parts of the arm and the joints are named; then let the children repeat the formula, with the appropriate touching, until it is perfectly memorized by them.

2. The Hand and its Parts.—We place a ball in a child’s hand, saying, Tell what you can do with this ball?—“I can throw it, I can catch it, I can hold it.” How can you move a pail of water with your hand?—“I can lift it.” What can you do with a bell-rope?—“I can pull it.” What can you do with your hand when you place it upon different things?—“I can feel with it.” If you can hold with your hands, for what may you say your hands are used?—“My hands are used for holding.” For what else may your hands be used?—“For throwing, catching, lifting, pulling, pushing, feeling.” From these replies the formula is constructed: “My hand is used in holding, throwing, catching, and feeling,” which is repeated as the children extend the right hand, and hold the right wrist with the left hand.

The children are taught to name the front part of the hand,

the palm of the hand, and to clap when it is mentioned; also to touch the back of the hand gently without making any sound.

What are at the ends of your hands? — “My fingers.” How many fingers have you on one hand? — “Five.” Look at what you call your five fingers, and notice whether they are alike or different. What do you think about them? — “They are not all the same length.” What is the shortest one called? — “The thumb.” How many are always called fingers? — “Four.” Then what have you on each hand? — “A thumb and four fingers.”

We next let the children pass their thumbs in front of each of their fingers, then try to do the same with their other fingers, which they find to be impossible. We explain that this peculiarity about the thumb makes it possible for us to use our hands in many different ways, especially in picking up objects and holding them; that without the thumb we could not button or unbutton gloves or anything else; indeed, the hand would be quite useless if we had no thumb.

How many thumbs has a dog? — “None.” Can a dog pick up things with his paws? What does he use to take hold of things? — “His mouth and teeth.” What does an elephant use for hands? — “His trunk.” What does a monkey use to hold on with when he is climbing? — “His four feet.” The children are surprised when they learn that what they have called feet are the four hands of the monkey, each having a thumb similar to that on our hands, so that the monkey can take hold with its four hands somewhat as we do with two.

The name of each of the fingers is next given, according to the formula; the forefinger, because it is in front of the other fingers in the line between the thumb and fingers; the middle finger, because in the middle of the fingers; the ring finger, where the ring is placed; the little finger, the smallest of the fingers. In naming the fingers, the children place the left hand at the thumb of the right hand, and pass it around the outside of all the fingers to the thumb again, as they say, “My fin-

gers"; then they touch and move the thumb and each finger successively.

Raise your hands, open and close them very quickly. What do you name the parts of the fingers where you can bend them? — "Finger joints and knuckles." What do you call the end of a pointer? — "The point, the tip." What may you call the ends of your fingers? — "The tips of my fingers." What do you see on the back of your hands beneath the skin? — "Veins." Look at the lower part of your thumb; what do you notice about it? — "It is fat, it is thick." We show them a portion of the surface of the ball, and lead them to call the fleshy part at the base of the thumb, the ball of the thumb, because it is curved somewhat like a part of a ball.

Why would you not like to wear very tight kid gloves all the time? — "They would hurt; we could not move our hands every way." Why not? — "We could not bend our fingers without tearing the glove." Look at your hand; what is under the flesh and skin? — "Bones." Yes, and the flesh and skin cover these bones somewhat as a glove covers the hand. What would be the trouble if the flesh and skin were drawn very tightly over the bones of the hand? — "I could not move my fingers very easily." What do you see on the palms of the hands? — "Lines." On what other parts of the hand do you see lines? — "On the fingers." Upon which part of the fingers? — "On the joints." Partly close your hands; what do you notice about these lines? — "The flesh is bent at the lines." What may you say when you tell about the lines? — "The lines show where the flesh is bent." We teach that God has given us our wonderful hands to enable us to help ourselves; that they should be kept clean; that they must not be used in fighting or stealing, but in doing acts of kindness and usefulness.

"Hands were made to be useful,
If you teach them the way;
Therefore for yourself or neighbor
Make them useful every day."

3. *The Parts of the Leg and Foot.* — The parts and joints of the leg and foot are taught in about the same manner as those of the arm and hand; then touched and named according to the formula. A shoe is very useful for illustrating the parts of the foot, and a jointed doll for those of the limbs.

THE JOINTS.

(The following Lesson is usually taught after the Lessons on the Bones.)

How many parts has the arm? — “Two.” How many joints has the arm? — “Three.” How many parts has the leg? — “Two.” How many joints has the leg? — “Three.” What are joints? — “Bending places.” Raise your right hand; move it backward and forward at the wrist. Move your arm up and down at the elbow. Open the desk; move the lid up and down. What enables you to move the desk lid? — “Its hinges.” What has the arm instead of hinges? — “Joints.” How can you move the desk lid? — “Up and down.” How may you move the door? — “Backward and forward.” How can you move your hand at the wrist, or your arm at the elbow? — “Up and down, backward and forward.” What enables you to move your arm at these places? — “The joints.” What are the joints like in the way they work? — “Hinges.” We talk about the formation of the wrist joint, illustrating the fitting of the bones together and their motions upon each other, by fitting the fingers together and moving them backward and forward; then ask, What will you call the wrist joint because of the way you can move it? — “A hinge joint.”

Which of the other joints of the body are hinge joints? After thinking awhile the children reply, “The finger joints, the knee joints, the ankle joints, the toe joints.” Why do you call these joints hinge joints? — “Because they move like hinges.”

How may you move your arm at the shoulder? — “Up and down, backward and forward, round and round.” A few experiments show the children that the arm may be moved at the shoulder as it cannot be at the wrist and the elbow. Then we show them a cup and ball, and an old-fashioned jointed wooden doll; with these we explain the formation of the upper part of the upper arm, also the cavity of the shoulder which receives it; we ask, What kind of a joint is the shoulder joint? — “A ball-and-cup joint,” is the ready reply. After substituting the word *socket*, we obtain the amended answer, “A ball-and-socket joint.”

How can you show that the shoulder joint is a ball-and-socket joint? — “By moving my arm in every direction.”

Then why do you call the shoulder joint a ball-and-socket joint? — “Because it moves like a ball in a socket.” Which are the ball-and-socket joints? — “The shoulder joint, the hip joint.”

From the explanation already given, the children are prepared with a little assistance to describe the two kinds of joints of which they have learned. See Questions on the Joints and Parts of the Limbs.

The positions of the various parts are easily obtained from the children; it is not necessary, therefore, to show the method of development; the result will be found in the replies to the Questions to which we have referred.

FORMULA FOR THE PARTS AND JOINTS OF THE BODY.

1. My limbs are my two arms and my two legs.

2. My arm has two parts:

my upper arm,

my fore-arm;

and three joints:

my shoulder joint,

my elbow joint,

my wrist joint.

3. My hand is used in holding, throwing, catching, and feeling :

the palm of my hand,	my little finger,
the back of my hand,	my knuckles,
my fingers,	my finger joints,
my thumb,	my nails,
my forefinger,	the tips of my fingers,
my middle finger,	the veins,
my ring finger,	the ball of my thumb,
and the lines where the flesh is bent.	

4. My leg has two parts :

my thigh,	and my lower leg ;
-----------	--------------------

and three joints :

my hip joint,	my knee joint,
my ankle joint.	

5. My foot is used in standing, walking, running, skating, and jumping :

my instep,	the hollow,
my toes,	the heel,
the sole of my foot,	my toe joints,
the ball,	and my toe nails,
which protect my toes.	

QUESTIONS FOR THE FORMULA.

1. Which are your limbs ?
2. Tell about your arm.
3. Tell about your hand.
4. Tell about your leg.
5. Tell about your foot.

DIRECTIONS FOR TOUCHING.

The hands are crossed to touch the *arms*, and not crossed when the legs are touched.

In describing the *arm*, the left arm is extended, and its parts and joints are touched with the right hand as each is mentioned.

The left hand is extended and held at the wrist with the right hand as the use of the *hand* is described.

The children clap when the *palm* is named ; turn the *back* of the hand upward and touch it ; pass the right hand around the *fingers* of

the left hand, beginning with the *thumb*, and touch each finger with the right index finger. The *knuckles*, *finger joints*, *nails*, *tips of the fingers*, *veins*, *ball of the thumb*, and *lines* where the flesh is bent are also touched with the same index finger as each is named.

Before describing the *leg* and *foot*, the children, at a given signal from the teacher, place the left leg over the right knee, then put the left hand in the lap, and touch with the right hand as each part and joint is mentioned.

They sit erect as they tell the use of the *foot*, then bend very slightly forward to touch its parts with the right hand, which is passed down the *instep*, across the *toes*, along the *sole*, over the *ball*, in the *hollow*, around the *heel*, and across the *toe nails*. As the clause "which protect my toes" is repeated, the children resume the erect posture.

QUESTIONS ON THE LIMBS AND JOINTS OF THE BODY.

Touch and name the parts of your body. — "The head, the trunk, the limbs."

Touch and name the parts of your head.

Touch and name the parts of your trunk.

What is the trunk of your body? — "All the body but the head and limbs."

Which are your limbs? — "My two arms and my two legs."

How many limbs have you? — "Four."

How many parts has your arm? — "Two parts: my upper arm and my forearm."

How many parts has your leg? — "Two parts: my thigh and my lower leg."

How many joints has your arm? — "Three joints: my shoulder joint, my elbow joint, my wrist joint."

How many joints has your leg? — "Three joints: my hip joint, my knee joint, my ankle joint."

What are joints? — "Bending places."

How many kinds of joints have you? — "Two: hinge joints, and ball-and-socket joints."

What kind of a joint is the shoulder joint? — "A ball-and-socket joint."

Why do you call the shoulder joint a ball-and-socket joint? — "Because at the shoulder the arm may move in any direction."

Tell how the shoulder joint is made. — "The upper end of the bone of the upper arm is rounded and fastened in a hollow place called a socket."

Which of the joints of the arm and hand are hinge joints? — "The elbow joint, the wrist joint, the thumb joint, the finger joints."

Which of the joints of the leg and foot are hinge joints? — "The knee joint, the ankle joint, the toe joint."

Which of the joints of the leg is a ball-and-socket joint? — "The hip joint."

Where is the heel? — “At the back part of the foot.”

Where is the ball of the foot? — “On the sole of the foot, behind the great toe.”

Where is the hollow of the foot? — “In the middle of the sole of the foot.”

Where is the sole of the foot? — “On the bottom of the foot.”

Where is the instep? — “Between the ankle joint and the toes.”

Where is the lower leg? — “Between the knee joint and the ankle joint.”

Where is the thigh? — “Between the hip joint and the knee joint.”

Where is the upper arm? — “Between the shoulder joint and the elbow joint.”

Where is the forearm? — “Between the elbow joint and the wrist joint.”

Where are the toe joints? — “Between the parts of the toes.”

Where are the finger joints? — “Between the parts of the fingers.”

Where is the ankle joint? — “Between the lower leg and the foot.”

Where is the knee joint? — “Between the thigh and the lower leg.”

Where is the hip joint? — “Between the trunk and the thigh.”

Where is the wrist joint? — “Between the forearm and the hand.”

Where is the elbow joint? — “Between the upper arm and the forearm.”

Where is the shoulder joint? — “Between the trunk and the upper arm.”

Where are the tips of the fingers? — “At the ends of the fingers.”

Where is the ball of the thumb? — “On the palm of the hand below the thumb.”

Where is the palm of the hand? — “On the inside of the hand, between the wrist and fingers.”

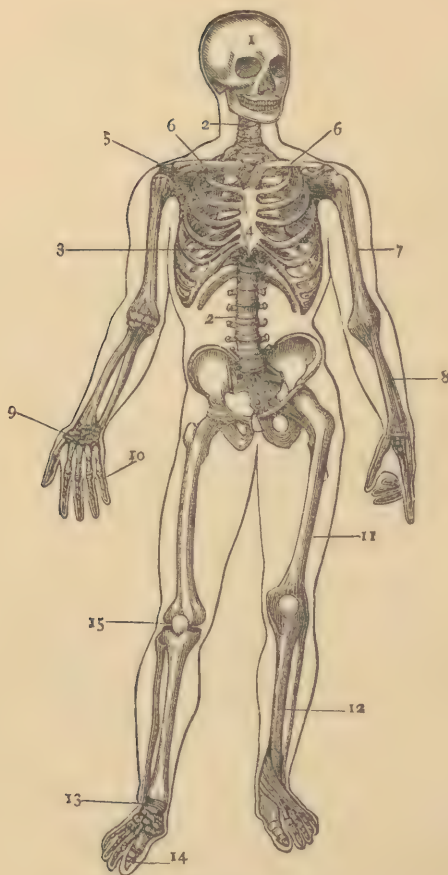
BLACKBOARD OUTLINE.

1. THE LIMBS.

THE ARM.	THE HAND.	THE LEG.	THE FOOT.
Parts { The upper arm, The forearm.	Used in { Holding, Throwing, Catching, Feeling.	Parts { The thigh. The lower leg.	Used in { Standing, Walking, Running, Skating, Jumping.
	Parts..	Joints { The hip joint, The knee joint, The ankle joint.	Parts..
	{ The palm, The back, The knuckles, The finger joints, The nails, The tips of the fingers, The veins, The ball of the thumb, The lines where the flesh is bent.		{ The instep, The toes, The ball, The hollow, The heel, The toe joints, The toe nails.

2. JOINTS OF THE LIMBS.

NAMES.	KINDS.	WHY SO CALLED.	HOW MADE.
Finger joints, toe joints, Wrist joints, ankle joints, Elbow joints, knee joints.	Hinge joints.	(See Question on the Parts and Joints of the Limbs.)	(See Question on the Parts and Joints of the Limbs.)
Shoulder joint, hip joint.	Ball-and-socket joints.		



THE SKELETON.

- | | |
|-------------------------------|---------------------------------|
| 1. The skull. | 8. The bones of the forearm. |
| 2. The spine. | 9. The bones of the wrist. |
| 3. The ribs. | 10. The bones of the fingers. |
| 4. The breastbone. | 11. The bone of the thigh. |
| 5. The shoulder blades. | 12. The bones of the lower leg. |
| 6. The collar bones. | 13. The bones of the ankle. |
| 7. The bone of the upper arm. | 14. The bones of the toes. |
| 15. The kneecap. | |

PART III.

THE BONES OF THE BODY.

1. *Introductory.* — Of what is your body built? — “Of bones.” How do your bones feel to the touch? — “Hard.” You may make a sentence telling about your bones. — “My bones are hard.”

These words are printed on the board. Are your bones all of the same size? A correct answer to this question is obtained after the children have felt the bones of their fingers and arms. Are all your bones of the same shape? After feeling those of the head and arms, they usually reply, “Some are curved, some are like a cylinder.” Of what use do you think your bones are to your body? — “They make my body strong.” The answer is printed as given, and the children read the entire sentence, “My bones are hard; they make my body strong.”

2. *Bones of the Head.* — We show the class a dog's or a sheep's skull, and ask, What is this? — “A skull.” Of what is it made? — “Of bone.” To what part of the dog or sheep did it belong? — “To the head.” Touch your skull. What is your skull? — “The head; the bony part of my head.” What other bone belongs to your head? By placing the hand upon the chin, while opening and closing the mouth several times, some of the children discover what they usually call “the chinbone.” If we find they know no other name for the bone, we say, This chinbone is called the jawbone.

What is in your jaw? — “My teeth.” How many jaws have you? — “Two.” What do you call this one? we ask, as we point to the upper jaw. “The top jaw.” Give another name for top. — “Upper.” Then what may you call the top jaw?

“The upper jaw.” If the top jaw is called the upper jaw, what may you call the other? — “The under jaw, the lower jaw.” We accept the latter name, and bid them name and touch the bones of the head. — “The bones of the head are my skull and my lower jaw.” We tell them that there are about two hundred bones in the body, not including the teeth; fourteen of these are in the face, four small bones are in the ears, and one at the root of the tongue. Then we show the pupils how to touch as they give an account of the bones of the head and face.

3. *The Bones of the Trunk.* — What do you feel along the middle of the back? — “The backbone.” Yes, the backbone, or *the spine*. In what part of the body do you find the spine? — “In the trunk.” What other bones do you find in the trunk? — “The side bones; *the ribs*.”

We bid them feel the short, upright bone in front, and give them its name, *breastbone*; then direct them to place the right hand at the upper part of the left shoulder, and move the left arm in different directions; this leads them to notice the projecting bones which they usually name “shoulder bone.” We give them the name *shoulder blade*, and after a similar experiment with the right arm, ask, How many shoulder blades have you? — “We have two shoulder blades.”

The children find the two bones crossing the top of their chest from the tip of the shoulder to the breastbone, and learn the name *collar bones*; the number of these, two; the shape, somewhat like the Italian *f* placed in a lying position, is shown by making this letter on the board. Lastly, we assist them to construct and memorize the Formula for the Bones of the Trunk.

4. *The Bones of the Arm and Hand.* — We tell the children there is only one bone in the upper arm, and two in the forearm; that the bones of the forearm are so arranged that we are able to turn the hand at the wrist from side to side; also, that there are two rows of bones in the wrist, four in each row, eight in all, forming the wrist joint. . .

We let a child spread his hand upon the blackboard, and trace its outline with chalk; then bid the class draw the fore-finger of the left hand down over the bone leading from the thumb knuckle to the wrist. A line corresponding to this bone is drawn within the traced hand. In the same way the children discover and represent all the bones of the middle of the hand, and thus learn the position and number of these bones, so that they can readily give the statement, "From my wrist to my knuckles are five bones." By looking carefully at the thumb, the children are able to tell us the number of its bones, for which two marks are made within the thumb part of the picture. In like manner, the number and position of all the bones of each finger is noted and represented.

All the lines made within the picture are counted and numbered, to prepare the class to touch and count the bones of the hand, as well as to give a correct answer to the question, How many bones in your hand? Lastly, they are taught to repeat the Formula for the Bones of the Arm and Hand.

5. *The Bones of the Leg and Foot.* — We teach the number of the bones of the leg by reference to those of the arm; then bid the children place the left leg over the right knee, and touch the thigh with the right hand as they say, "My thigh has one bone." They touch the lower leg as they say, "My lower leg has two bones."

We ask, How many bones are in the wrist? — "Eight." There is one less bone in the foot near the heel. How many bones are there in the foot in that place? — "Seven." We tell them that the missing bone seems to have taken its place over the knee joint, which it covers and protects; then let them count as many balls on the numeral frame as there are bones near the heel. How many bones from the wrist to each finger? — "One." Yes, and there is one from the heel to each of the toes. How many bones in the middle of the foot? — "Five." Five more balls are counted on the numeral frame. There are the same number of bones in the great toe as in the thumb. How many balls shall we count for them? — "Two."

Each of the other toes has as many bones as each of the fingers. How many balls shall we count for the bones of the second toe?—"Three." How many for the third toe?—"Three." For the fourth?—"Three." For the fifth?—"Three." For the sixth?—"None; we have not six toes." We let the children count the whole number of balls which have been moved, to find the number of bones in the foot; then require them to look at the balls as they say:—

In my foot, near my heel, are seven bones;

In the middle of my foot are five bones;

My great toe has two bones;

Each of my other toes has three bones;

Making twenty-six bones in my foot.

This lesson is taught more rapidly if we use for illustration a chart representing the Osseous System.

FORMULA FOR THE LESSON ON THE BONES OF THE BODY.

1. My bones are hard; they make my body strong. There are about two hundred bones in my body.

2. The bones of my head are

my skull and my lower jaw;

my face has fourteen bones; my ear has four small bones; at the root of my tongue is one bone.

3. The bones of my trunk are

my spine,

my breastbone,

my ribs,

my two shoulder blades,

• and my two collar bones.

4. My upper arm has one bone; my forearm has two bones; my wrist has eight bones; from my wrist to my knuckles are five bones; my thumb has two bones; each finger has three bones, making nineteen bones in my hand.

5. My thigh has one bone; my lower leg has two bones; my kneecap is the cap which covers and protects my knee; in my foot, near my heel, are seven bones; in the middle of my foot are five bones; my great toe has two bones; each of my other toes has three bones; making twenty-six bones in my foot.

QUESTIONS FOR THE FORMULA.

1. Tell about your bones.
2. Tell about the bones of the head.
3. Tell about the bones of the trunk.
4. Tell about the bones of the arm and hand, beginning with the upper arm.
5. Count the bones of the hand.
6. Tell about the bones of the leg and foot, beginning with the thigh.

DIRECTIONS FOR TOUCHING.

The Head. — The hands are placed above and around the *skull*, and down each side of the *lower jaw*. The right hand is passed down the *face* when the number of its bones are given; the index finger points to the left ear as the number of the bones in the *ear* are mentioned.

The Trunk. — Both hands are passed to the back to touch the *spine*; around the *ribs*, and on the *breastbone*, as they are named. The *shoulder blades* are touched from above the shoulders, and both hands are brought forward to indicate the position of the *collar bone*.

The Arm and Hand. — The left arm is extended and the right hand used to touch its parts, as the bones of the *arm* are enumerated. The same hand is used to touch the *wrist*, also from the *wrist to the knuckles*. The *thumb* and *fingers* are touched by the right index finger as the number of their bones is given.

The method of counting the bones of the hand is described hereafter.

The Leg and Foot. — The directions for touching the bones of the leg are the same as those given for touching its parts.

The right hand is used to touch the *left heel*, and the *middle of the foot*, when the number of the bones in these parts are named. As the bones of the *toes* cannot be easily felt through the shoe, the children sit erect when they tell about them, and quietly replace the left foot upon the floor at the conclusion of the clause, "making twenty-six bones in my foot."

QUESTIONS ON THE BONES.

How many bones in the body? — "About two hundred."

Of what use are the bones to the body? — "They make the body strong; they form the framework of the body."

How many bones in the face? — "Fourteen bones."

How many bones in the ear? — "Four small bones."

How many bones at the root of the tongue? — "One."
 How many bones in the upper arm? — "One."
 How many bones in the forearm? — "Two."
 How many bones between the wrist and the knuckles? — "Five."
 How many bones in the thumb? — "Two."
 How many bones in each of the fingers? — "Three."
 How many bones in the whole hand? — "Nineteen."
 How many bones in the hand and arm? — "Thirty."
 How many bones in the thigh? — "One long bone."
 How many bones in the lower leg? — "Two."
 How many bones in the heel? — "Seven."
 How many bones in the middle of the foot? — "Five."
 How many bones in the great toe? — "Two."
 How many bones in each of the other toes? — "Three."
 How many bones in the whole foot? — "Twenty-six."
 How many bones in the foot and leg? — "Thirty."
 How many bones in two arms and two hands? — "Sixty."
 How many bones in two legs and two feet? — "Sixty."
 How many bones in the limbs? — "One hundred and twenty."
 Where is the kneecap? — "Over the knee joint."
 Where is the longest bone in the body? — "In the thigh."
 Where are the smallest bones of the body? — "In the ear."
 Touch the collar bones.
 Touch the shoulder blades.
 How many collar bones have you? — "Two."
 How many shoulder blades have you? — "Two."
 Touch the spine.
 Touch the breastbone.
 Touch the skull.

DIRECTIONS FOR TOUCHING THE BONES OF THE HAND.

I.

1. Close both hands.
2. Raise the forefinger of the right hand, as the index or pointing finger.
3. Place the index finger upon the lower thumb joint of the left hand.
4. Draw the index finger down to the wrist, over the bone between the thumb knuckle and the wrist, and count "One."
5. Place the index finger on the knuckle of the first finger.
6. Draw the index finger down to the wrist, over the bone leading from the first finger to the wrist, and count "Two."
7. So on, for each of the three other bones of the hand. Repeat until no mistake is made in touching or counting.

II.

1. Raise the thumb, and place the index finger of the right hand on the middle of the upper part of the thumb for bone "Six"; then

2. On the lower part of the thumb for bone "Seven." Repeat from the beginning, until the children can touch and count each bone properly.

III.

1. Keep the thumb erect; raise the first finger of the left hand.

2. Place the index finger on the bone between the tip and the first joint of the first finger for bone "Eight."

3. Between the first and middle joint for bone "Nine."

4. Between the middle and third joint for bone "Ten." Review, from the beginning, until the class can touch and count every bone as directed.

IV.

1. Keep the thumb and forefinger erect; raise the second finger and touch, as in the lesson on the first finger bones, "Eleven," "Twelve," and "Thirteen." Review.

2. Proceed in the same manner for the third and fourth fingers, always beginning with the bone nearest the tip of the finger, and touching that at the lowest part last.

If the exercise has been properly performed, every child will say "Nineteen" as its index finger touches the lowest bone of the little finger, and all the fingers of every left hand will be outspread.

Sometimes the children have an amusing and profitable pantomime exercise on the bones of the body, as follows: We say to them, I will touch the different parts of the body, and you may show with your fingers how many bones in each. Two or three attempts will enable them to go through these motions with accuracy, and prepare them to answer the questions on bones with rapidity. Unless using a Chart of the Osseous System, we ask about the bones of the leg and foot, instead of pointing to these parts on the chart. The children answer by signs, as before.

NOTE. — To obtain from the children the number of the bones in the body, we ask for those of the head, the trunk, the upper limbs, the lower limbs, and the number of each. The several replies appear on the blackboard as follows : —

THE BONES

OF THE HEAD :		OF THE TRUNK :	
Skull	8	Spine	24
Face, including the	} 14	Ribs	24
lower jaw		Breastbone	8
Tongue	1	Shoulder blades	2
Ears	8	Collar bones	2
	31		60

OF THE UPPER LIMBS :		OF THE LOWER LIMBS :	
Upper arms	$1 \times 2 = 2$	Thighs	$1 \times 2 = 2$
Forearms	$2 \times 2 = 4$	Kneepans	$1 \times 2 = 2$
Wrists	$8 \times 2 = 16$	Lower legs	$2 \times 2 = 4$
Hands	$19 \times 2 = 38$	Feet	$26 \times 2 = 52$
	60		60

Total, 211, not including the teeth.

We teach the children to say “about two hundred,” because there are not always the same number of bones in the body. In some parts two or three bones unite and form one bone. For example : the breastbone of a child is made up of eight pieces ; some of these unite as it becomes older, so that when fully grown it has but three pieces in this bone.

PART IV.

THE ORGANS OF SENSE.

The Eye. — What do you see with? — “My eyes.” Hold your heads perfectly still; look at the ceiling; look at the floor; towards the right side of the room; towards the left; in front of you. This exercise is repeated until every child of the class can look in these various directions without moving the head. Then we take our box of forms, and, holding a cube before the children, ask: What shape is this? — “A cube.” How many of you would like eyes shaped like cubes? No hands are raised, showing they do not think the shape desirable. Why do you not wish cube-shaped eyes? — “They would not look nice; they would not be pretty; they would not look well.” What other reason have you against this shape for an eye? If the children do not reply correctly to this question, we repeat the exercise of rolling the eyes without moving the head, and soon obtain the desired answer, “They could not be rolled about.”

What reasons have you given for not wishing eyes shaped like cubes? — “They would not look well; they could not be rolled about.” The children, for the same reasons, object to having eyes shaped like prisms or pyramids. We show them a cylinder. They are better pleased with this shape, and seldom say of it, “It does not look well.” Some think it will do, but others discover that it cannot be rolled up or down, which convinces them that cylinder-like eyes would not be very convenient. For similar reasons they decide against the hemisphere, cone, and spheroid.

When called upon to choose the proper shape for an eye, they unhesitatingly select a ball, or sphere, “Because it looks well; because it can be moved in every direction,” and reply

correctly to the question, What shape is your eye? — “My eye is shaped like a ball.”

We place before them the skull of a dog, and let them find where the eyes of the animal were placed. In what were the eyes placed? — “In holes; in hollow places.” What word have you learned which means a hollow place? — “Socket.” Of what was the socket made in which the dog’s eye was placed? — “Of bones.”

We next tell the children to feel around their own eyes; this act leads them to perceive that their eyes are also placed within a deep, bony socket, and the class is ready to answer, “My eye is like a ball in a deep, bony socket,” when we ask about the shape and position of the eye.

We direct the attention of the pupil to the position of the eye, — in the upper part of the face, instead of in the hand, or in the back or sides of the head, and quiet the mirthfulness excited by the thought of eyes in these inconvenient and ludicrous situations, by alluding to the goodness and wisdom of our kind Heavenly Father, as displayed in the position and shape of our eyes.

Why do the eyes not stand out from the face as the nose does? — “They would get hurt.” Then why are they placed in the deep, bony socket? — “To keep them from getting hurt; to protect them.”

Look into the eyes of the child next to you. What do you see in them? — “A black spot; something blue; a white part.” Of what shape is the black spot? — “Round.” Round like what? — “Round like a circle.” Where is it? — “In the middle of the eye.” Pointing to the window, we ask. Of what shape is the window? — “Oblong.” Of what use is it? — “To let the light in; to see through.” We then explain that the little black spot in the eye is an opening in the eyeball through which the light enters, and out of which the mind sees the world. What, then, is the eye to the body? — “The window.” We tell the children that this window is called the *pupil* of the eye.

We talk to them about the camera which the photographer uses when he makes pictures ; telling them that the inside of the camera-box is like the glassy part of the eye, — for the light to pass through; a portion of the inside of the eye is ready to receive the picture the light paints on it, as the glass the artist places in the camera receives the picture, when they sit or stand, during a few seconds, where he has placed them in front of the camera-tube.

We bid them look at different things, informing them that as they turn from an object its picture passes as quickly from the picture-plates of their eyes, and that of the next thing at which they look takes its place. Light, the great picture-maker, is always at work, giving views of things near and far away, according as the eyes are ready to receive its pictures. If they hurt their eyes they cannot see through them ; if their eyes are injured by accident or disease, they must be deprived of the pleasant sights so freely given to all who can see. We counsel them to use their eyes, illustrating our meaning by the familiar story of “ Eyes and no eyes,” which tells of two travellers passing through the same scenes, the one seeing nothing to interest him, the other adding to his store of knowledge through his habit of careful observation ; we also lead them to understand how necessary it is to take care of these seeing-balls, remind them to be thankful to the Giver of light and eye-sight, and teach them of His omniscience by the familiar words, “ He that formed the eye, shall He not see ? ”

Lastly, the class construct and memorize the sentence, “ The black circle in the centre is the pupil or window of my eye.”

What do you see around the pupil of the eye? — “ A ring.” Of what color? — “ Gray ; light brown ; dark brown ; blue.” We ask the color of the same part of the eye in the cat, rabbit, or other animals ; give the name *iris*, then proceed to show its use to the eye as follows : Close the shutter of the window. What do we do when we close the shutters? — “ Shut out the light.” When we open it a little? — “ Let in a little light.” When we open it wide? — “ Let in all the light that will come

in through the window." What do we sometimes use instead of shutters? — "Shades, curtains." What shaped shutters, shades, or curtains would you use for an oblong window? — "Oblong."

We bid a child stand where the class can look into its eyes as the bright light shines into them; the other children see the small pupil and enlarged colored ring; we then let the same child stand in a dark corner where the rest can see the pupil enlarge, the iris becoming smaller. The children soon learn that the iris has something to do with letting in and keeping out the light, and thus acts as a curtain to the eye; that because the eye-window, or pupil, is round, its curtain must be round, but ring-shaped, that it may not completely cover the pupil. This portion of the lesson is concluded with the formula, "The colored ring is the iris or curtain."

What else do you notice in the eye beside the pupil and the iris? — "A white part." What shape is it? — "Curved." What is the curved part? After thinking awhile, some of the children reply, "The front part of the eyeball," and give the statement, "The white part is the eyeball."

We say to the children, Bend your head down; bend it backward. Why did your eyes not fall out? — "They are in tight." What holds them in so tightly? None can tell us; so we inform them of the six little elastic cords of flesh, which have power to make themselves long or short, and not only hold the eye in the socket, but turn it in any direction we wish to look.

What cover your eyes? — "The eyelids." Of what use are they? — "They cover the eye; they keep the dust out; they keep the eyeball from getting hurt; they protect the eye," are the various answers given, as the class is led to imagine what would be the consequence if we had no eyelids.

How many eyelids have you? — "Two." What do you name them? — "Top eyelid, upper eyelid, under eyelid, lower eyelid." We accept the terms, upper eyelid and lower eyelid, then assist the class to construct the formula, "My upper and lower eyelids cover and protect my eyes."

What have you above the eyelids? — “Eyebrows.” Of what are the eyebrows composed? — “Of little hairs; of short hairs.” Of what use are the eyebrows? The children do not know. We help them to infer the use of these parts by asking, How would you look without eyebrows? — “Strange, queer.” Then of what use are the eyebrows? — “To make us look nice; to make us look pretty; to make us look beautiful.” We teach them to express the same idea by the words, “My eyebrows are for beauty.” What comes out upon the forehead when you are very warm? — “Sweat.” *Perspiration* is substituted as a preferable word, and we explain that the eyebrows keep the perspiration of the forehead from rolling into the eyes. The children touch the eyebrows as they repeat the formula, “The eyebrows are for beauty, and keep the perspiration from rolling into my eyes.”

What are on the edges of the eyelids? — “The eyelashes.” Of what are the eyelashes made? — “Of short hairs.” How would people look without eyelashes? — “Queer, strange.” Then of what use are the eyelashes? — “They make us look nice; they make us look pretty.” What did you say about the eyebrows because they make you look better than you would without them? — “My eyebrows are for beauty.” Then what may you say about your eyelashes because they add to your good looks? — “My eyelashes are for beauty.” What do you see in the street when it is very windy? — “Dust.” The air is always moving, and the dust is always flying about, though you may not see it; the little eyelashes sweep away the dust when it comes near the eyes, and prevent it from entering the eyes.

In repeating the formula which follows the conversation about the eyelashes, the children touch these parts as they are named: “My eyelashes are for beauty, and brush away the dust from my eyes.”

We bid all raise the right hand who have seen a sewing-machine, and ask, Why do people put oil on different parts of the machine? — “To make it go fast; to make it go easily.” We say to the children, You may look up; look to the right;

to the left ; look in front of you. What do you do with your eyes as you look in these different directions? — “ I move my eyes.” Does it hurt the eyeballs to move them? They reply in the negative, and we explain that the eyeballs are washed by the tears, which are made back of the eyebrows, and rubbed over the eyeball by the motion of the eyelids ; that these tears make the eyeballs move easily in the sockets, without hurting or wearing out ; that they pass from the eyes through little openings which lead from the eyes to the nose. When we feel very unhappy or sad, the tears are made so rapidly in the eye-factory that they cannot pass into the nose fast enough, so they roll down the cheeks when we cry.

The lessons on the eye end with the talk about the tears, and the formula, “ My eyes are washed by teardrops every time I wink my eyelids,” which is repeated without touching.

THE ORGANS OF SENSE. — *continued.*

The Ears. — Of what use are your ears? — “ To hear with.” Where are they placed? — “ One on each side of the head.”

We bid the children feel and bend the ears, then tell of what these are made, which leads to the discovery that the outer ear is made of something different from flesh and bone. We ask the name of the hard, tough, smooth substance they find in some meat, and from the replies given obtain the word *gristle* ; then tell them that the outer ear is made of gristle, or, as some people call it, cartilage ; lastly, teach them to define cartilage as, “ A smooth, elastic substance, harder than flesh and softer than bone.”

Allusion is made to the difference in the position of the ears of various animals, and the children are led to notice that those of animals which pursue their prey point forward to catch sounds in front of them, while those of others which are liable to be pursued turn backward to hear sounds from behind them. The ears of the cat and the rabbit are good and familiar illustrations of these facts.

Next, the parts of the outer ear are touched and named by the class, — the outer edge is designated as the *rim*, and the lower part through which an earring may be placed, as the *flap* or *lobe* of the ear.

We speak of the trumpet-like shape of the ear as best adapted for catching and holding sounds ; then explain that sounds pass through the opening of the ear, along a short tube, and strike against a thin skin stretched tightly across a hollow place inside of the ear, called the *drum-head* ; that the four bones of the ear, the smallest bones in the body, are placed across the drum cavity, and help to carry sounds to the brain.

We talk about the ear-wax, and the fence of short, stiff hairs stretched across the tube of the ear in front of the thin skin, to keep insects from entering the drum of the ear.

We counsel the children to endeavor to preserve their hearing, by taking care to avoid colds, and caution them against putting any hard, sharp-pointed instrument, such as a pin, into the ear, by which the delicate parts of the ear may be injured. Lastly, the Formula for the Ear is prepared and memorized.

The Nose. — Of what use is the nose? — “To smell with ; to breathe through.” Where is the nose? — “Between the two eyes ; between the forehead and the mouth ; in the middle of the face.” By measuring the face from the top of the forehead to the chin, and across the face from ear to ear, the children are led to perceive that the nose is in the middle of the face.

Why is the nose placed above the mouth? — “To enable us to smell quickly what we put into the mouth.” Why is it placed in the middle of the face? — “Because it looks best here.” How queer the nose would look at the back of the head or the forehead !

What name do you give to the upper part of the nose between the eyes? — “The bridge of the nose.” What is the lower end of the nose called? — “The tip of the nose.” What else do you notice about the nose? — “Two holes ; two openings.” What are they called? — “The nostrils.” Of what use are

they? — “For the air to pass through.” We explain that these nostrils lead to two openings through which the air enters the back of the mouth on its way to the lungs.

What is between the nostrils? From what they have learned about the substance of the outer ears, the children readily discover that the division between the nostrils is formed of cartilage, and tell us this cartilage divides the nostrils into two parts. We give them the word *separates* as used in the formula for this section of the lesson.

We conclude with the repetition of the formula, teaching the children to touch the *bridge* and the *tip* of the nose with all the fingers of the right hand, to point to the *cartilage* with the forefinger, and to the *nostrils* with the thumb and forefinger of the same.

The Mouth. — Of what use is the mouth? — “To speak with; to eat with.” Its position is alluded to, and its parts, the lips, are mentioned. What is inside of the mouth? — “The tongue; the upper teeth; the lower teeth.”

In what are the teeth placed? — “In the jaw.” How many jaws have you? — “Two.” What are they called? — “Top jaw, under jaw.” are the names the children usually give, which we correct to upper jaw and lower jaw.

What covers the jaws? — “Flesh.” Of what color is this flesh? — “Red.” What is it called? If no child can reply correctly, we give the name “gum.” and then teach the formula, instructing the children to touch only when they name the lips.

The Teeth. — Of what use are the teeth? — “To eat with.” Of what other use are they? None of the class know, so we bid the children make the sounds of two or more of the vowels: then those of *b*, *p*, *d*, *t*, *v*. After several repetitions of their sounds, they readily perceive that the vowel sounds are made by different positions of the mouth as the voice passes through it; that *b* and *p* are made with the lips, while to make *f*, *v*, *t*, *d*, they must use the teeth. Our second question is repeated,

and we receive the correct reply: "To speak with; to help speak with."

Of what are the teeth made? — "Bones." Comparison is made between the teeth and the other bones of the body; some of the children think they are exactly alike, others that they are different. "The teeth are white, smooth, and shiny." We explain that this is because they are covered with a smooth, hard substance, called enamel, which keeps them from wearing out, as paint and varnish help to preserve the wood they cover. We teach the class to spell the word *enamel*, and to define it as "a smooth, glossy, white substance, harder than bone."

When you take a bite of apple, between which teeth do you place the apple? — "Between the front teeth." Why? — "To bite the apple." In what other way could you take a piece from the apple? — "I could cut it with a knife." Then what do you use your front teeth for when you eat? — "For biting; for cutting." What may you call them because they are used for cutting? — "Cutting teeth; cutters."

What kind of teeth have you noticed on the sides of a cat's jaws? — "Sharp, pointed teeth." What does the cat use these teeth for? — "To tear meat with." What may you call the teeth with which the cat tears its meat? — "Tearing teeth; tearers." You may feel or look at your own teeth and notice whether you have any teeth which resemble the tearing teeth of the cat. — "We have; on each side of the front teeth." Then what kind of teeth have you besides cutting teeth? — "Tearing teeth; tearers."

If you wish to crack a nut with your teeth, where do you place it? — "Between the back teeth." Why? — "Because they are the thickest; because they are the strongest." Yes, and best fitted for breaking and grinding hard substances; but wise people do not crack nuts with their teeth. What may you call the double back teeth because they are used in grinding the food? — "Grinding teeth; grinders."

Name the kinds of teeth we have been talking about. — "Cutting teeth, tearing teeth, grinding teeth." Where are the

cutting teeth, or cutters?—“In the front part of each jaw.” Where are the tearing teeth, or tearers?—“On each side of the cutting teeth.” Where are the grinding teeth, or grinders?—“At the back part of each jaw; on each side of the tearing teeth.”

We tell the class that children do not have as many teeth in a full set as adults, or grown people, and give them the number of the milk teeth, also of the permanent teeth. The little ones know by experience that they lose their first teeth, and are supplied with a second set. We explain that the second teeth are formed in the jaw, below the first set, and will push the latter out if these are not extracted soon enough to give the new teeth room. The formula for the teeth is taught and repeated without any touching.

The Preservation of the Teeth.—We begin the lesson on this subject by asking the children how they use anything which they do not wish to wear out. “We try to keep it; we take care of it.” Usually some one replies, “We try to preserve it”; if not, we give the class the word *preserve*, and develop its meaning by referring to preserved flowers and fruits. What do you think you must do to preserve your teeth?—“We must keep them clean.” We explain that anything which injures the enamel destroys the teeth, because the soft inner portion of the teeth soon decays when not protected by the hard enamel; then lead the class to understand why tartar should not be allowed to collect about the teeth; why very hot or very cold food and drink should be avoided; why thread should not be cut or nuts cracked with the teeth; and why tobacco and cigars should be kept out of the mouth,—because all these may injure the enamel more or less. After these explanations, the children are assisted to construct the rules for the preservation of the teeth, which are soon memorized.

The Process of Eating.—By holding the lower jaw, and simulating the process of eating, the children learn that the lower jaw only is moved in the act of chewing. They tell us

that the cutters cut the food, the tearers tear it, and the grinders grind it. We ask what change takes place in a dry piece of bread or cracker when it is in the mouth. — “It is made wet.” We give the word *moistened* for “made wet.” What moistens the bread? — “The spit.” *Saliva* is substituted for “spit,” and they tell us, “The saliva moistens the bread.” A little reflection helps them to understand that all food put into the mouth is moistened by the saliva. We instruct them about the work of the tongue, as it moves in the mouth during eating, bringing the food between the teeth, and helping to throw the food-ball down the food-pipe when we are ready to swallow.

The formula for this portion of the lesson is constructed in the usual manner, and memorized; it is repeated without any touching.

FORMULAS FOR THE LESSONS ON THE ORGANS OF SENSE.

1. *The Eyes*.—My eyes are to see with.

My eye is like a ball in a deep, bony socket. The black circle in the centre is the pupil or window of my eye; the colored ring is the iris or curtain; the white part is the eyeball.

My upper and lower eyelids cover and protect my eyes.

My eyebrows are for beauty, and keep the perspiration from rolling into my eyes.

My eyes are washed by teardrops every time I wink my eyelids.

2. *The Ears*.—My ears are to hear with :

the rim of my ear,	the flap of my ear,
the drum of my ear.	

The drum of my ear is protected by a fence of short, stiff hairs, and by a bitter wax about the roots of these hairs.

3. *The Nose*.—My nose is to smell and breathe with; it is in the middle of my face :

my two nostrils,	the cartilage,
the bridge of my nose,	the tip of my nose.

My nostrils lead to a passage back of my mouth through which I breathe.

The cartilage separates my nose into two parts.

4. *The Mouth*.—My mouth is to speak and breathe with :

my upper lip,

my lower lip.

In my mouth are :

my tongue,

my upper teeth,

my lower teeth,

and my upper and lower jaws,

covered with flesh called *gum*.

5. *The Teeth.*—My teeth are used in eating and talking.

My teeth are bones covered with enamel.

I have three kinds of teeth: cutting teeth, tearing teeth, grinding teeth.

A young child has twenty teeth, ten in each jaw.

A grown person has thirty-two teeth, sixteen in each jaw.

6. To preserve my teeth:

I must keep them clean.

I must not scratch the enamel.

I must not eat or drink anything very hot or very cold.

I must not use them for scissors or nut-crackers.

I must not burn them with tobacco or cigars.

7. *About Eating.*—When I eat I move my lower jaw only.

My tongue brings the food between my teeth.

the cutters cut it,

the tearers tear it,

the grinders grind it,

the saliva moistens it,

and my tongue helps me to swallow it.

QUESTIONS FOR THE FORMULAS.

1. Tell about your eyes.
2. Tell about your ears.
3. Tell about your nose.
4. Tell about your mouth.
5. Tell about your teeth.
6. What is necessary if you would preserve your teeth?
7. Tell about eating.

2. Tell about your ears.

3. Tell about your nose.

4. Tell about your mouth.

5. Tell about your teeth.

6. What is necessary if you would preserve your teeth ?

7. Tell about eating.

DIRECTIONS FOR TOUCHING.

The Eyes.—The hands are placed upon the *eyes* as these are named. The right forefinger is passed around the socket of the left eye as the word *bony* is repeated.

The *upper* and *lower eyelids* and *eyebrows* and the *eyelashes* are touched with the fingers as each of these parts is mentioned.

The Ears.—The *ears* are touched when named in the first sentence of the formula. The *rim* and the *flap* of the ear are each touched with the right forefinger, which is also used in pointing to the *drum* of the ear.

The Nose.—The fingers of the right hand are used to touch the *nose* and its parts, excepting the *nostrils*, which are touched by the thumb and index finger of the same hand.

The Mouth.—The *mouth* is touched with the fingers of the right hand, and each *lip* with the right forefinger.

The Teeth, Manner of Eating, Preservation of the Teeth.—No touching is necessary in these sections.

QUESTIONS ON THE DESCRIPTION OF THE EYES.

Of what shape is the eye? — “It is round like a ball.”

In what is it placed? — “In a deep, bony socket.”

What is a socket? — “A hollow place.”

Why is the eye placed in a deep, bony socket? — “To keep it from getting hurt.”

Why would not an eye shaped like a cube do for us? — “It would not look well; it could not be rolled about.”

Why would not an eye shaped like a cone or cylinder do for us? — “It could not be rolled in every direction.”

Why is the ball-shape best for the eye? — “It looks best, and may be rolled in every direction.”

What part of the eye do we see through? — “The black spot in the centre.”

What is it called? — “The pupil.”

What shape is the pupil? — “Round like a circle.”

What color is the pupil? — “Black.”

Of what use is the pupil? — “To let light into the eye; to see through.”

What is around the pupil? — “A colored ring.”

What is the colored ring called? — “The iris.”

Of what use is the iris? — “It acts like a curtain to the eye; it lets in and keeps out light from the pupil.”

Of what shape is the iris? — “Round like a ring.”

Of what color is the iris? — “Sometimes blue, sometimes brown, sometimes gray.”

Does the iris always appear the same in size? — “It does not: sometimes it looks large, sometimes small.”

When is it the largest? — “When it rolls over the pupil to keep out the strong light.”

When is it the smallest? — “When it rolls backward, to let light into the pupil.”

When is the pupil the largest? — “When we are in the dark.”

When is the pupil the smallest ? — “ When we are in a bright light.”

What color is the eyeball ? — “ White.”

What shape is the eyeball ? — “ Round like a ball.”

How is the eyeball held in its socket ? — “ By cords made of flesh.”

Where are the eyebrows ? — “ Above the eyelids.”

Of what use are the eyebrows ? — “ To keep the perspiration from rolling into the eyes.”

Where are the eyelids ? — “ Over the eyes.”

Of what use are they ? — “ They cover my eyes and keep them from getting hurt.”

Where are the eyelashes ? — “ On the edges of the eyelids.”

Of what use are the tears ? — “ They keep the eyes clean; they make the eyes move easily in their sockets.”

Where are the tears made ? — “ Back of the eyebrows.”

When do the tears wash the eyes ? — “ Every time we wink our eyelids.”

QUESTIONS ON THE EARS.

Touch the parts of the ear.

Where are your ears ? — “ On the sides of my head.”

Which is the rim of the ear ? — “ The edge of the ear.”

Which is the flap of the ear ? — “ The lower part of the ear.”

Where is the drum of the ear ? — “ Inside of the ear.”

How is the drum protected ? — “ By stiff hairs and a bitter wax at its entrance.”

QUESTIONS ON THE NOSE.

Where is the nose ? — “ In the middle of the face.”

Touch the parts of the nose.

Where is the tip of the nose ? — “ At the end of the nose.”

Where is the bridge of the nose ? — “ At the top of the nose between the eyes.”

Where is the cartilage ? — “ In the middle of the inside of the nose.”

Of what use is the nose ? — “ To smell and breathe through.”

What are the nostrils ? — “ The openings inside of the nose.”

Of what use are the nostrils ? — “ To let the air into and out of the opening back of the mouth.”

QUESTIONS ON THE MOUTH, ETC.

Where is the mouth ? — “ In the lower part of the face, between the nose and the chin.”

Touch the mouth.

Of what use is the mouth ? — “ To breathe, speak, and eat with.”

What is in the mouth ? — “ My tongue, my upper teeth, my lower teeth, and my upper and lower jaws.”

What covers the jaws ? — “ Red flesh, called *gum*.”

Of what are the jaws composed ? — “ Of bones.”

Of what are the teeth made? — “Of bones covered with enamel.”

What is enamel? — “A smooth, white substance, harder than bone.”

Of what use are the teeth? — “To eat and talk with.”

What kinds of teeth have you? — “Cutting teeth, tearing teeth, grinding teeth.”

Describe the cutting teeth. — “The cutting teeth have broad and flat edges.”

Describe the tearing teeth. — “The tearing teeth are sharp and pointed.”

Describe the grinding teeth. — “The grinding teeth are the thick, back teeth.”

Which jaw is moved in eating? — “The lower jaw.”

What work do the teeth perform? — “They cut, tear, and grind the food.”

How many teeth has a child in a full set? — “Twenty teeth: ten in each jaw.”

How many teeth has a grown person in a full set? — “Thirty-two: sixteen in each jaw.”

What does the tongue do in eating? — “It rolls the food between the teeth, and helps in swallowing.”

What is the saliva? — “A kind of liquid, sometimes called *spit*.”

Of what use is it in eating? — “It wets and softens the food.”

What do you mean by preserve? — “To keep from injury.”

What do you mean by injury? — “Hurt.”

How do you preserve your teeth? See Formula.

How do very hot or very cold drinks hurt the teeth? — “They crack the enamel.”

What happens if the enamel is cracked? — “The teeth decay.”

Then what must you do to preserve your teeth? — “I must try to keep the enamel from being cracked or injured in any way.”

BLACKBOARD OUTLINE. — THE ORGANS OF SENSE.

1. THE EYES.

POSITION.	USE.	PARTS.	COLOR OF PARTS.	SHAPE OF PARTS.	USE OF PARTS.	RULES FOR HEALTH.
Below the forehead; each side of the nose; in a deep, bony socket.	To see with.	The pupil or window. The iris or curtain. The eyeball. The eyebrows. The eyelashes. The eyelids.	Black. Blue, brown, or gray. White. Black, brown, etc. Black, brown, etc. Flesh color.	Circle. Ring. Ball. (rescent. Fringe. Curved.	To see through; to let light in. To let in and keep out light from the pupil. To move in the socket; to hold the seeing parts. For beauty, etc. (See Formula.) To cover and protect the eyes.	The eyes must not be used in too strong light. The eyes must be rested when tired.

2. THE EARS.

In the middle of each side of the head.	To hear with.	The rim. The flap. The drum.	Flesh color. Flesh color. Flesh color.	Curved.	To catch sound. To hear with.	The ears must be kept clean.
---	---------------	------------------------------------	--	---------	----------------------------------	------------------------------

3. THE NOSE.

In the middle of the face.	To breathe and smell with.	The bridge. The two nostrils. The tip. The cartilage.	Flesh color. Flesh color. Flesh color. Flesh color.		To breathe through and smell with. To separate the nostrils.	
----------------------------	----------------------------	--	--	--	---	--

4. THE MOUTH.

Between the nose and the chin.	To breathe, eat, and speak with.	The lips. { The tongue. { The jaws.	Red. Red. Red.	Crescent. Oblong. Curved.	To breathe and speak with. To speak and taste with. To hold the teeth.	
--------------------------------	----------------------------------	---	----------------------	---------------------------------	--	--

5. THE TEETH.

In the jaw, inside of the mouth.	To eat with, and help in talking.	The crown. The root. (The enamel.)	White. White. White.	Pointed.	To chew with. To hold the tooth in the jaw. To preserve the teeth.	(See Formula.)
----------------------------------	-----------------------------------	--	----------------------------	----------	--	----------------

PART V.

DESCRIPTION OF THE BONES.

1. *The Skull.* — We show a sheep's or dog's skull to the children, and let them examine it carefully, to discover how its parts are put together; then, two pieces of paper, each shaped more or less like a carpenter's saw, or two pieces of wood prepared for dovetailing, are placed together, to help the class illustrate and describe the mode of joining. Attention is called to the parts of the human skull, and how they are united; also, to the use of the skull, its shape and strength; after which the formula which describes it is prepared and memorized.

2. *The Spine.* — Where is your spine? — “In the middle of the back.” Where does it begin? — “At the lower part of the skull.” What word do you sometimes use which means lower part? — “Base.” This word, familiar to those who have studied about a cone, in the lesson on form, is substituted for *lower part*; the meaning of *extends* illustrated and taught, then the position of the spine is described by the children, in the words of the formula they have assisted to make.

They are accustomed to think of the spine as one long bone. This error is corrected by bidding them notice what they feel as they pass the fingers over the upper part of the spine. “Little round lumps,” they tell us, and we explain that the lumps or knot-like parts are little, round, perforated bones, twenty-four of which make the spine; that these are placed one above the other, like cups turned upside down. We ask, How are the lumps or bones of the spine placed? — “One on top of the other.” Allusion to a pile of slates or books obtains the desired word, *piled*, which expresses the position described. We tell them about the cartilage between these bones,

explaining its use in preventing injury to the brain when we walk or move about. Their knowledge of the terms, *elastic* and *flexible*, help them to understand that these layers of cartilage enable us to bend the back, and then assume an upright position, at will.

You have learned that "the spine is made up of little bones piled one upon the other, with cartilage between every one of them." What do you think is the reason why these bones and pieces of cartilage do not fall apart, as slates do, when you strike against a pile of them? — "They are fastened together." Show, with your right forefinger, in what position the spine of a horse is placed; show that of your own spine as you sit or stand; what do you call this position? — "Vertical." Yes, but you do not talk about standing or sitting in a vertical position; what other word do you use? — "Erect; up straight." "Up straight" is corrected to *upright*, and the word *column* taught by reference to a column of words or figures; also, to pillars they may have seen in school or elsewhere. The backbone of a fish helps the children to understand something of the construction of the spine.

3. **The Ribs.** — What name do you give to the bones on your side? — "Ribs." If possible, we show a picture of the ribs; let the children count those on one side, and notice the form and position of each: otherwise, we let them find these bones in their own body, and describe the form, and tell where fastened at the back and in front. We talk about the use of the ribs, — to be as a wall around the lungs, heart, and stomach; therefore, they must be strong; each must also be light, because, if heavy, twenty-four of them would weigh too much for our comfort.

4. **The Shoulder Blades.** — A picture of a shoulder blade is shown to the class, and the children feel for their own shoulder blades; they are instructed as to the shape and use of these bones, and assist, as usual, in constructing the descriptive formula.

5. *The Collar Bones.* — The position and shape of the collar bones are best taught from a chart representing the Osseous System. If we have no chart, we let the children feel for them, on the upper part of the chest, and try to discover their shape; also, where they are joined. We also show, on the blackboard, that a collar bone resembles an Italian *f* placed in a horizontal position. The use of these bones in keeping the arms in place is easily explained.

6. *Hygiene of the Bones.* — Why should we not let young babies stand too often? — “Because it will make them bow-legged; their legs will grow crooked.” Why will their legs become crooked? — “Because their bones bend easily.” What word may you use when you wish to tell that the bones bend easily? — “Flexible.” Then what may you say about a baby’s bones, when you wish us to understand that they may be easily bent? — “They are flexible.” How do the bones of a baby feel to the touch? — “Soft.” How do those of an old person feel? — “Hard.” Which bones break the more easily, those of a child, or those of a grown person? After thinking awhile, some of the children reply, “Those of an old person.” What word would you use to describe the bones of an old person, so as to tell that they are easily broken? — “Brittle.”

When the difference in the quality of the bones of childhood and age is understood by the pupils, they are prepared to tell us why it is necessary for old people to be very cautious against falling, and why children and young persons must be careful to sit and stand erect; also, why they must not wear tight clothing. The formula for this portion of the lesson is repeated without touching.

From what are bones made? — “From the blood.” From what is blood made? — “From the food I eat.” What kind of bones would you like to have? — “Strong bones; healthy bones.” What kind of blood is needed to make strong, healthy bones? — “Good or pure blood.” What kind of food makes pure blood? — “Wholesome food.” Then what kind of food

must you eat if you would have strong, healthy bones? — “Wholesome food.” As soon as the children understand that wholesome food is necessary to make good bones, they help in the preparation of the formula we desire them to memorize.

Of what use is the air to the blood? — “It makes the blood pure.” What kind of bones will pure blood make? — “Good bones; strong bones.” What kind of bones will bad blood make? — “Bad bones; weak bones; poor bones.” What should you not breathe if you wish strong, healthy bones? — “Impure air.” Why should you not breathe impure air? — “Because impure air makes bad blood, and bad blood makes poor bones.”

How many of you have a canary at home? What happens to its feathers in the spring? — “The old ones fall out, and new ones come in their place.” What may you say about a canary, when you think of this change of its feathers? — “A canary is not always covered with the same feathers.” Are you always covered with the same skin? Amused at this question, the children quickly reply in the affirmative. We tell them their answer proves how easily people may make mistakes when they only guess at things; then proceed to prepare them to answer our question correctly and intelligently. If you put on a new pair of shoes, and walk in them through the streets, why should not the shoemaker take them back if you wish him to do so? — “Because they are dirty; because they are worn a little.” If you keep on wearing the shoes every day for several weeks, what happens to them? — “They are worn out.” If a child walks barefoot do his feet wear out? — “They do not.”

Again we show that guessing does not always give correct answers, and explain that bones, flesh, and skin wear out, little by little, as we use the different parts of the body; that the little, worn-out particles, finer than chalk-dust, are removed, and their places constantly supplied by new particles of bone, flesh, and skin made from the wonderful blood; that this wearing out and repairing is going on continually, so that the body is constantly changing; some portions very often, and others more slowly and less frequently.

Conclusion. — We conclude the lesson with the formula concerning this change in the substance of the body ; then review the Description of the Bones, by the repetition of the several formulas which have been prepared during the lesson on this subject.

FORMULA FOR DESCRIPTION OF THE BONES.

1. My skull is formed of several bones united, like two saws with their toothed edges hooked into each other.

2. My spine extends from the base of the skull behind, down the middle of my back.

It is composed of twenty-four short bones, piled one upon the other, with cartilage between them.

These bones are fastened together, forming an upright and flexible column, which makes me erect and graceful.

3. My ribs are curved, strong, and light ; there are twenty-four of them, twelve on each side ; they are fastened at the back to my spine, in front to my breastbone, forming a hollow place for my heart, lungs, and stomach.

4. My shoulder blades are flat, thin, and like a triangle in shape ; they are for my arms to rest upon.

5. My collar bones are fastened to my shoulder blades and my breastbone ; they keep my arms from sliding too far forward.

6. The bones of old people are hard and brittle ; those of children soft and flexible ; so I must sit and stand erect, that mine may not be bent out of shape. I must not wear tight clothing, or do anything that will crowd them out of their places.

7. My bones are made from my food, after it has been changed into blood ; so I must be careful to eat good, wholesome food, that they may be strong and healthy.

8. I must not breathe impure air, because impure air makes bad blood, and bad blood makes poor bones.

9. The body of every person is changing all the time, because the skin, flesh, and bones are always wearing out, and the blood is always repairing and building them again.

QUESTIONS FOR THE FORMULA.

1. Tell about the skull.
2. Tell about the spine.
3. Tell about the ribs.
4. Tell about the shoulder blades.
5. Tell about the collar bones.
6. Tell about the difference between the bones of old people and those of children.
7. Of what are your bones made?
8. If you wish your bones to be strong, why should you not breathe impure air?
9. What have you learned about the change which is always taking place in the body?

DIRECTIONS FOR TOUCHING.

The Skull.—The hands are placed above and around the *skull* as the name is mentioned. As the word *hooked* is repeated, the fingers of the right hand are interlaced in those of the left to show how the skull bones are united.

The Spine.—Both hands are placed at the back to touch the *spine*; the right hand is placed *at the base of the brain*, and passed *down the middle of the back*, to indicate these parts. The average length of the bones of the spine is measured on the left forefinger with the right forefinger as the word *short* is repeated; *piled* is shown by placing the right forefinger upon the left; *upright*, by holding the right forefinger in a vertical position; and *flexible*, by bending it up and down several times. Each child should sit as erect as possible when the word *erect* is mentioned.

The Ribs.—As the clause, “twelve on each side,” is repeated, the hands are placed on the sides; both hands are used in touching the *spine* and the *breastbone*; to show *hollow places*, the hands are put together at the wrist and the tips of the fingers, and held so that the opening shall be in a vertical position; care is taken to keep the thumbs close to the fingers. The right hand is used to touch the *heart*; the hands are crossed upon the *lungs*; finally, the right hand is again used to indicate the position of the *stomach*.

The Shoulder Blades.—These are touched from above the shoulders when named. Their shape is illustrated by closing all but the first finger of the left, and the first and second fingers of the right hand;

the left forefinger is held vertically to form one side of a *triangle*, which is completed by using the right forefinger as the base, and the middle finger as the third side of the figure.

Collar Bones. — A hand is placed on each side of the *collar bones* as they are mentioned; then upon the *shoulder blade*, to show where the collar bones are fastened: both hands touch the *breastbone* when it is named.

Hygiene. — As the children repeat the words, “So I must sit and stand erect,” they assume a very erect posture, to give emphasis to what they are repeating.

QUESTIONS ON THE DESCRIPTION OF THE BONES.

Touch the skull.

Of what is it made? — “Several bones united together.”

How are the skull bones united? — “Like two saws with their toothed edges hooked into each other.”

What do you mean by *toothed*? — “Having points, like teeth.”

What covers the skull? — “Flesh, skin, and hair.”

Of what use is the skull? — “It protects the brain.”

What is the brain? — “That part of my body in which the thinking is done.”

Where is the spine? — “It extends from the base of my skull behind, down the middle of my back.”

What do you mean by *extends*? — “Goes from.”

What do you mean by *base*? — “The lower part of anything.”

Of what is the spine made? — “Of about twenty-four short bones, with cartilage between them.”

What is cartilage? — “An elastic substance, harder than flesh, but softer than bone.”

How are the bones of the spine placed? — “They are piled one upon the other.”

What do you mean by *forming*? — “Making.”

What do you mean by *upright*? — “In a vertical position.”

What do you mean by *flexible*? — “Easily bent.”

What do you mean by *column*? — “A pillar.”

What do you mean by *erect*? — “In a vertical position.”

Why is cartilage placed between the bones of the spine? — “To make the spine flexible; to keep the brain from injury when we walk or run.”

What do you mean by *elastic*? — “Springing back after having been stretched, squeezed, twisted, or bent.”

Tell about your ribs. — “My ribs are curved, strong, and light.”

Where are your ribs? — “On each side of my trunk.”

How many ribs have you? — “Twenty-four; twelve on each side.”

How are your ribs fastened? — “At the back to my spine; in front to my breastbone.”

What do your ribs form? — “A hollow place for my heart, lungs, and stomach.”

Where are your shoulder blades? — “In the upper part of my back.”

What shape are they? — “Flat, thin, and like a triangle.”

Of what use are your shoulder blades? — “For my arms to rest upon.”

Touch your collar bones.

Where are they fastened? — “To my shoulder blades and my breastbone.”

Of what use are your collar bones? — “They keep my arms from sliding too far forward.”

Of what are your bones made? — “Of food after it has been changed into blood.”

Why should you eat wholesome food? — “That my bones may be strong and healthy.”

How does impure air hurt the bones? — “Impure air makes bad blood, and bad blood makes poor bones.”

Why should you sit and stand erect? — “Because my bones are easily bent out of shape; if I do not sit and stand erect, they will grow crooked.”

Why is it wrong to wear tight clothing? — “Because tight clothing crowds the bones out of shape.”

Whose bones are the more brittle, those of a child, or those of an old person? — “Those of an old person.”

What do you mean by *brittle*? — “Easily broken.”

Whose are the more flexible? — “Those of a child.”

What do you mean by *flexible*? — “Easily bent.”

What repairs the worn out bones, flesh, and skin of the body? — “The blood.”

What do you mean by *repairs*? — “Mends.”

What causes the bones, flesh, and skin of your body to change often? — “The bones, flesh, and skin are always wearing out, and the blood is always building and repairing them again.”

What are alcoholic liquors? — “Liquors which have alcohol in them.”

Name some alcoholic liquors. — “Beer, wine, rum,” etc.

Whose bones mend the more easily when broken, the bones of those who drink alcoholic liquors, or those of the people who do not use these poisons? — “The bones of those who *do not* use alcoholic liquors.”

What other poison hurts the bones? — “Tobacco.”

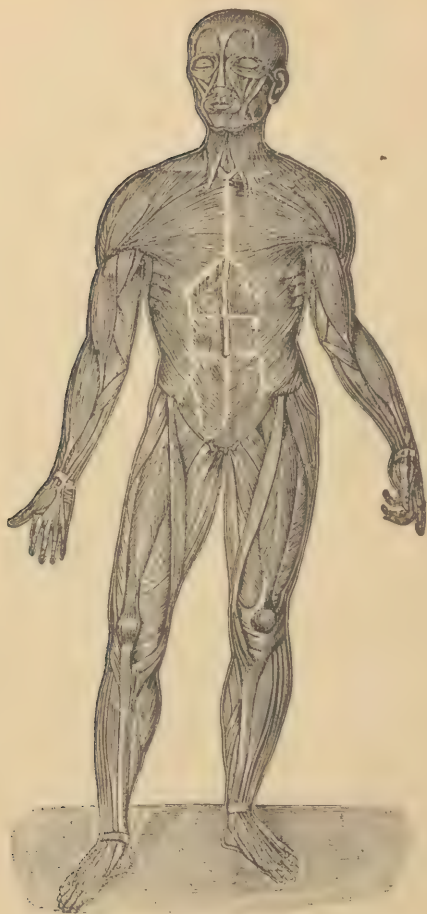
How do alcohol and tobacco hurt the bones? — “They make bad blood, and bad blood makes poor bones.”

DESCRIPTION OF THE BONES.

BLACKBOARD OUTLINE.

DESCRIPTION OF THE BONES.

	COMPOSED OF	POSITION.	SHAPE.	USE.	RULES FOR HEALTH.
THE SKULL	Several bones, with saw-toothed edges, hooked into each other.	At the top part of the body.	Somewhat like a hollow sphere.	To hold the brain, the eyes, the ears, and the nose.	I must sit, stand, and walk erect, that my bones may not be bent.
THE SPINE	Twenty-four short bones, piled one upon the other, with cartilage between them.	From the base of the skull, down the middle of the back.	An upright jointed column.	To support the head and other parts of the body.	I must not wear tight clothing, or do anything to crowd them out of their places.
THE RIBS.	Twenty-four bones, curved, strong, and light,—twelve on each side.	Around each side of the trunk, fastened to the spine and breastbone.	Somewhat like a hollow cone.	To hold the heart, lungs, and stomach.	I must eat wholesome food to supply them with good blood.
THE SHOULDER BLADES	Two bones, flat, thin, and triangular.	At the upper part of the back, near the shoulders.	Triangular.	For the arms to rest upon at the shoulders.	I must not breathe impure air, because impure air makes bad blood, and bad blood poor bones.
THE COLLAR BONES	Two long, doubly curved bones.	At the top of the front part of the trunk, below the throat; fastened to the shoulder blades and the breastbone.	Somewhat like an Italian <i>f</i> .	To keep the arms from sliding too far forward.	I must not poison my blood with alcohol or tobacco, because poisoned blood makes unhealthy bones.



FRONT VIEW OF THE MUSCLES OF THE BODY.

PART VI.

THE MUSCLES.

1. *Introduction.*—You may stretch your arm to its full length; place your left hand on the front part of your upper arm, half way between the shoulder and the elbow; what do you feel?—“Thick flesh.” Move your right forearm up and down; as your left hand rests on your upper arm, what do you feel?—“Something moving.” Move your right thumb several times in front of the other fingers of the right hand; move each thumb in front of its own hand; what do you feel?—“Something moving under the skin; the flesh moving.” What do you say your bones are covered with?—“Flesh.” What you call flesh, grown people name *muscles*; then with what may you say your bones are covered?—“With muscles.” Of what use do you suppose these muscles are to the body?—“They hide the bones; they make the body look better.” What did you find some of them do when you moved your arm and thumbs?—“They moved.” What do you think they move? The children cannot tell, so we explain that the muscles move the bones, and may be called “the bone-movers” of the body; also, they hold, or support the bones.

Open and shut the eyelids. What moved the eyelids?—“Muscles.” How many bones are there in the eyelids?—“Not any.” Hold your chin so as not to move the lower jaw, while you open your lips and give the first sound of the letter *u*. What moved the lips?—“Muscles.” How many bones are there in the lips?—“Not any.” What move the different parts of your face when you laugh?—“Muscles.” What move your face when you cry?—“Muscles.” Through these ques-

tions, the children are led to notice that the muscles move all parts of the body, whether bony or not bony.

2. Description of Muscles. — How many of you have seen muscles? — “Nobody.” Why! have you never seen meat? Never eaten boiled beef or chicken? Did not what you eat cover bones? Now how many think they have seen muscles? What part of the body is muscle? — “The part we eat; the lean part; the lean meat.” Yes; the word *muscle* means “lean meat.” What color are the muscles? — “Red.”

We explain that the muscles are made up of a number of fine threads, or fibres of flesh, just as a piece of cord is made up of many threads of cotton or linen; that these are put together in bundles of various shapes; some spindle-shaped, some fan-shaped, some feather-shaped; that the spaces between the bundles are filled with fat, when the body is healthy and strong; and that the muscles are joined to the bones by a stronger kind of fleshy cord, called tendon, — a whitish substance, softer than bone, but harder than muscle; also that there are about four hundred and fifty muscles in the body. A piece of india-rubber cord, connecting the parts of a jointed doll, may be used, to help the children understand the elasticity of the muscles.

Where are the muscles? — “All over the body.” What are the parts of the body? — “The head, the trunk, the limbs.” What may you call these different muscles, because of their place, or position in the body? — “The muscles of the head, the muscles of the trunk, and the muscles of the limbs.”

3. How the Muscles are Moved. — Some move when we will to move them, as those of the hands and feet. Others do their work without our help. We often wink the eyelids, not knowing they have moved; and the heart, which is only a hollow muscle, is continually beating, *beating*, without our having anything to do with it.

4. Hygiene of the Muscles. — The effect of exercise upon the muscles is easily comprehended when we allude to the arms of a blacksmith, and ask the children why their own are not as

strong. The effect of habit is also understood, when we lead them to compare the shoulders of those who sit and stand in a stooping posture, with those of well-trained soldiers who walk and stand erect.

How do you feel when you have walked a long distance? — “Tired.” What should you do when you are tired from walking? — “Sit and rest.” We explain that different sets of muscles are employed in the different motions of the body; for instance, some are used when we walk, others when we stand, or sit; that muscles become tired when used too long a time without rest, which accounts for our fatigue, when we have walked too far, or sat too long in one position; and that nothing helps tired muscles but rest, either by change of employment or in sleep.

Muscles need good blood, and enough of it, to make them strong; so if we would have strong muscles, we must eat enough good, wholesome food to make good blood; we must also breathe pure air, and live in the sunlight, that they may be supplied with pure, healthy blood. If through illness, want of food, or over-fatigue, our muscles do not receive enough nourishment from the blood, they shrink in size, and lose strength, and we become thin, or, as we sometimes say, “lose flesh” — which means that we lose *muscle*.

Some people think alcoholic drinks make the muscles strong, but this is a mistake. Beer, wine, brandy, etc., weaken the muscles, and sometimes make those who use them unfit to work or walk, as you know is the case when a person is drunk.

FORMULA FOR THE LESSON ON THE MUSCLES.

1. Muscles are the red, elastic bands and bundles of thread-like substance, called flesh, which cover the bones and make the eyeballs, the eyelids, the tongue, the heart, the lungs, and various other parts of the body.

2. There are about four hundred and fifty muscles in my body.

3. The work of the muscles is to support and move my bones, and different parts of the body.

4. The muscles may be named the muscles of my head, the muscles of my trunk, the muscles of my limbs.

5. The muscles of my head cover and move the parts of my head and face. The muscles of my trunk cover and move the parts of my neck and trunk. The muscles of my limbs cover and move the parts of my arms and legs.

6. Those muscles are the weakest which I use least: those muscles are the strongest which I exercise most in work or play.

7. If I would be strong and healthy,
 my muscles must be used,
 my muscles must be rested,
 my muscles must be supplied with good blood.

I must exercise in work and play to make them strong; I must sleep, or change my kind of work or play, to give them rest, when they are tired; I must breathe pure air, take wholesome food and drink, and live in the sunlight, to supply them with good blood; I must not weaken them by using alcohol or tobacco.

QUESTIONS FOR THE FORMULA.

1. Tell about the muscles.
2. How many muscles have you in your body?
3. Of what use are the muscles?
4. How may the muscles be named?
5. Tell about the muscles of the head, trunk, and limbs.
6. Which muscles are the weakest, and which are the strongest?
7. What is necessary if you would have strong and healthy muscles?

DIRECTIONS FOR TOUCHING.

The hands are crossed and passed very rapidly down the arms, trunk, and legs, while the clause *cover the bones* is being repeated. A hand is placed on each eye to point to the *eyeball* and touch the *eyelids*; the tongue is touched by the tip of the right forefinger, the right hand is passed over the *heart*, and the hands crossed over the *lungs*, as each is mentioned. Both hands are used in touching the *head, trunk, and limbs*.

QUESTIONS ON THE MUSCLES.

What are the muscles? — "The lean flesh of the body; bands and bundles of fleshy threads which cover the body."

Of what use are the muscles to the body? — "They cover the bones; they support and move the bones and different parts of the body."

Name some parts of the body which are made of muscles. — “The eyeballs, the eyelids, the tongue, the heart, the lungs.”

What color are the muscles? — “Red.”

How do the muscles move the bones? — “By shortening themselves according to the way the bones are to be moved.”

Tell how the muscles move your arm at the elbow. — “The muscles in the front part of the arm shorten themselves, to draw my forearm toward the shoulder; when I wish to stretch out the forearm these muscles lengthen, while another set of muscles shorten, to draw the forearm away from the upper arm.”

What do you say about the muscles because they have the power to shorten and lengthen themselves? — “They are elastic.”

About how many muscles are there in your whole body? — “About four hundred and fifty.”

How may these be divided as you study about them? — “They may be divided into the muscles of my head, the muscles of my trunk, and the muscles of my limbs.”

Of what use are the muscles of your head? — “They cover and move the parts of my head and face.”

Of what use are the muscles of your trunk? — “They move the parts of my neck and trunk.”

Of what use are the muscles of your limbs? — “They move the parts of my arms and legs.”

How can you make your muscles strong? — “By using them.”

How can you make your muscles weak? — “By not using them.”

What is necessary to make your muscles strong and healthy? — “They must be used; they must be rested when tired; they must be supplied with pure blood.”

How should the muscles be used? — “They should be exercised in work or play.”

How may they be rested? — “I may rest my muscles by changing position; by changing my kind of work or play; or by going to sleep.”

Explain what you mean by changing your position. — “If I am standing, I must sit or lie down to rest them; if they are tired, because I have been sitting too long, I must rest them by standing, walking, or running.”

What do you mean by changing the kind of work or play? — “If, in my work or play, my arms become tired, I must do something in which my arms may rest, though other parts of my body may be in exercise.”

How may you help supply your muscles with good blood? — “By breathing pure air; by taking wholesome food and drink, and by living in the sunlight.”

How does drinking alcoholic liquors hurt the muscles? — “It makes them weak, and unfit to move the parts of the body.”

What wonderful muscle moves without your will? — “The heart.”

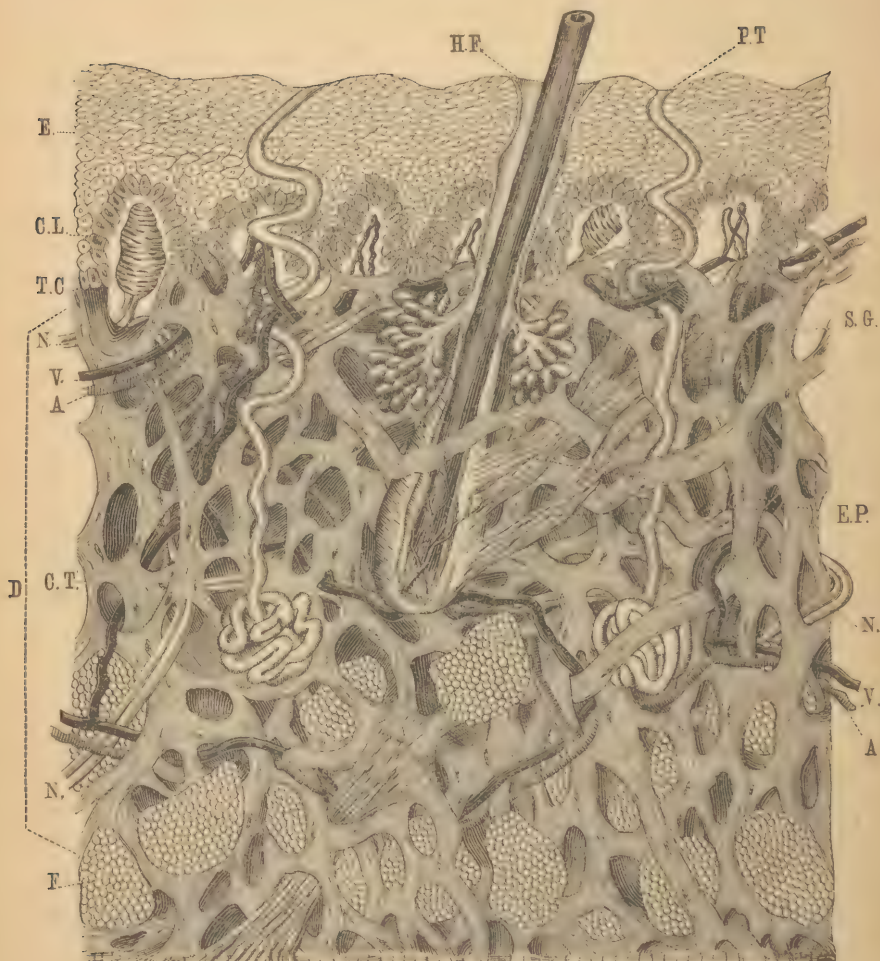
How does alcohol hurt the heart? — “It makes it beat too fast.”

How does “beating too fast” hurt the heart? — “It makes it tired, and sometimes wears it out.” See Appendices on Alcohol and Tobacco.

BLACKBOARD OUTLINE.

THE MUSCLES.

NAME.		USE.		RULES FOR HEALTH.	
Muscles of the	{ Head,	to cover and move the parts of the head and face.		To support and move the bones: To move the different parts of the body.	The muscles must be used. The muscles must be rested. The muscles must be supplied with good blood. (See Formula.)
	{ Trunk,	to cover and move the parts of the trunk.			
	{ Limbs,	to cover and move the parts of the limbs.			
ARR	ARRANGED IN	FORM THE	NUMBER.	USE.	RULES FOR HEALTH.
Red, elastic threads of flesh.	Bands and bundles.	Coverings for the bones; the eyelids, the eyeballs, the tongue, the heart, the lungs, etc.	About four hundred and fifty (450).		



— (From Walker's *Physiology*, 1884.)

THE SKIN (very highly magnified).

A, arteries; V, veins; N, nerves; F, fat cells; E, the outer skin; CL, the color layer; D, the true skin; PT, a perspiratory tube; HF, a hair and hair sac; EP, muscles; SG, oil glands; TC, tactile corpuscles; C.T., connective tissue.

PART VII.

THE SKIN.

1. *Introduction. Qualities of the Skin.* — What name do we give the outside covering of a tree? — “The bark.” What covers the muscles, or flesh of your body, as the bark covers the tree? — “The skin.” We lead the children to notice that their skin is thin, by comparing it with that of the pig or the elephant; that it will spring back after it has been stretched, squeezed, twisted, or bent, as they readily perceive by experimenting, and, therefore, it must be elastic; that it must be porous, because the perspiration oozes through it; that it will absorb ointment, and other substances applied to its surface in a more or less liquid form, and, therefore, must be absorbent.

2. *The True Skin.* — We bid them take a pin and put it through the surface of the skin on the palm of the hand, as they sometimes do in play. They notice that the blood does not flow, nor do they suffer pain from this experiment; but they would experience both effects if they pierced through what we teach them is the inner or true skin. We explain that the blood flows from the exceedingly fine blood-vessels of this skin; and pain is caused by touching the little nerves which send the message concerning their injury to the brain; still further, we tell the class that their blood-vessels are very close to each other, and when seen through a microscope, make the true skin look very much like a piece of delicate net-work.

3. *The Color of the Skin.* — Of what color is the skin of an Indian? of a Chinese? of a Negro? The children are surprised to learn that the true skin is of the same color in themselves as in the Indian, Chinese, Negro, or any other race of

men. They listen with interest as we explain that the difference in color is supposed to be caused by a jelly-like substance, which is found between the inner and the outer skin.

4. *The Thickness of the Skin, etc.* — They readily discover the difference in the thickness of the skin, as very thin and delicate on the lips, thick on the palms of the hands, and very thick and tough on the soles of the feet.

If you cut or scratch your finger, how long before it will heal? — “A few days.” When thoroughly healed, how will the skin appear where it was scratched? — “The same as it was before it was scratched.” What do you learn from this about the outside skin? — “That the outside skin will grow again after it has been cut or scratched.” Of what color is the skin where it was cut or scratched? — “The same color as the rest of the skin.” What does this show? — “That the jelly-like substance has come back.” If you have a severe burn, what do you notice after it is healed? — “A scar where the burn was.” We explain that the true skin has been destroyed, and in its place a sort of patch has been made by the blood; this patch is called a *scar*.

5. *The Pores of the Skin.* — What do you see on the surface of the skin when you are very warm? — “Sweat.” We give the preferable word, *perspiration*, and ask how the perspiration comes out on the skin. From what they have already learned, the children tell us, “Through its pores.” Yes, we reply; and you will wonder when you hear about the number of these pores.

We mark off an inch square on the blackboard, or place a piece of paper of this size on the palm of the hand, and tell the class that the number of pores in such a space on the body of an adult has been estimated and found to be 500 on the lower limbs; 1,000 on the forehead, head, neck, forearm, back of the hand and foot, and on the trunk; and 2,700 on the palm of the hand and sole of the foot; that each pore is the mouth or opening of a little pipe one-fifteenth of an inch long; that

the length of these tubes, all together, amounts to more than 153,000 inches, or 4,250 yards, — equal to between 2 and 3 miles of tubing to be emptied of perspiration. What an uncomfortable thought for boys and girls who do not wash very often !

6. *Perspiration and Hygiene of the Skin.* — What is perspiration, and why must it pass through the pores of the skin? We will see. When your mother is preparing for dinner, what does she do with the potato-parings, the corn-husks, and other things she does not wish to keep? — “She puts them into the garbage-barrel.” Why? — “Because they are of no use for food.” What do we sometimes call that which is of no use? — “Waste.” Usually some child gives the word; otherwise we write it on the board for the class to read.

Does your mother let the waste remain in the room, or cellar, or does she have it removed from the house? — “She has it removed from the house.” Why would it not do for the garbage to be kept in the house all the time? — “It would decay; it would smell bad; it would make the air impure; it would make us sick.” You know the food you eat makes blood, but some of that which you give to the stomach is of no use for blood-making; what would you call it? — “Waste.” What do you think should be done with it? — “It should be thrown away from the body.” You have learned that little particles of the bone, flesh, and skin, wear out; what should be done with them? — “They should be thrown away from the body also.”

There are several ways by which the body becomes rid of these useless particles and the waste portion of the food; one of these is through the perspiration, which is always passing out of the pores of the skin, when we are in health, although we cannot always see it; and thus carries away more than half of the waste substance of the body, through the three millions of little openings intended for its escape.

We convince the children that the perspiration comes through the surface of the skin, though they may not perceive it, by letting them place their apparently dry hands upon the surface

of a mirror, or a piece of highly-polished wood or steel; they notice the surface is dimmed with moisture; this, we tell them, is caused by the unseen perspiration, which is really passing through the pores of the skin in very fine portions, and mixing with the air around us, making it impure, and not fit to be breathed. If these pores are closed, what do you think will be the result? — “The perspiration will be kept in the body; the perspiration will not come out.” True; and if it is allowed to remain in the body, it will create disease in your body-house, as surely as the filthy garbage will cause disease in your mother’s house, if she does not have it removed. What do you think of people who keep the pores of their skin closed with dirt? — “They are very foolish; they will get sick.” What must you do if you would have a healthy skin? — “I must keep my body clean; I must wear clean clothing.”

What makes the skin? — “Blood.” What does the air do for the blood? — “Makes it pure.” Then what kind of air should you breathe if you would have a healthy skin? — “Pure air.” We teach that pure air is even more needful for the health of the skin than clean water is for its cleansing.

Most of the little folks know that plants kept in dark places become pale and sickly, and readily tell us we must also have enough sunlight, if we wish to have a healthy skin. We lead them to understand this need more fully, by explaining that the sun acts upon the blood in the body as really as it does upon the juices in the plants and trees.

Directions for Recitation. — The several portions of the “Formula on the Skin” are prepared and memorized as the formulas in other lessons; — the children give their thoughts in their own language, and we help them to express the same in the words we have chosen for them. In reciting the formula, they touch only when “the palms of the hands and the soles of the feet” are mentioned.

FORMULA FOR THE LESSON ON THE SKIN.

1. My skin covers my body.
2. It is thin, elastic, flexible, porous, and absorbent.
3. I have two skins; the inner skin is the true skin.
4. My true skin is elastic, and like a net-work of blood-vessels and nerves. My true skin is covered with a jelly-like substance which gives color to my skin.
5. My outside skin is not the same thickness over my whole body. In some parts, as on the palms of my hands and the soles of my feet, it is very thick and tough.
6. If my outside skin be destroyed, it will grow again; if the jelly-like substance be destroyed, it will re-appear; but if my true skin be destroyed, it will never be perfectly renewed.
7. More than half of the waste substance of my body passes from it through the pores of the skin, in the form of perspiration.
8. If I would have a healthy skin,
 I must perspire freely all the time,
 I must keep my body clean,
 I must wear clean clothing,
 I must breathe pure air,
 and live in the sunlight.

QUESTIONS FOR THE FORMULA.

1. Where is your skin?
2. Tell about the skin.
3. How many skins have you?
4. Tell about the true skin.
5. What difference is there in the thickness of your outside skin?
6. What happens if the different skins be destroyed?
7. What passes through the pores of the skin?
8. What is necessary if you would have a healthy skin?

DIRECTIONS FOR TOUCHING.

The children touch the *palm* of the left hand with the fingers of the right, and the *sole* of the left foot with the same fingers, as these parts are mentioned.

QUESTIONS ON THE SKIN.

Of what use is the skin? — “It covers the muscles of the body.”

What can you tell about it? — “It is flexible, elastic, porous, and absorbent.”

Why do you say it is flexible? — “Because it is easily bent.”

Why do you say it is porous? — "Because it is full of little holes, or pores."

Why do you say it is elastic? — "Because it will spring back after it is stretched, squeezed, twisted, or bent."

Why do you say it is absorbent? — "Because it will soak up liquids."

How many skins have you? — "Two; an outside skin, and an inner skin."

Which is the true skin? — "The inner skin."

Of what is the inner skin composed? — "Of blood-vessels and nerves."

How do you know that the outer skin has no blood-vessels? — "Because if I put a pin through the outer skin the blood does not flow out, as it would if I had cut a blood-vessel."

How do you know the outer skin has no nerves? — "Because if I put a pin through my outer skin it does not make me suffer pain, as it would if I had touched a nerve."

What gives color to the skin? — "A jelly-like substance between the inner and the outer skin."

What have you learned about the true skin? — "That it is of the same color in people of every nation."

What difference is there in the thickness of the outer skin? [See Formula.]

What passes through the pores of the skin? [See Formula.]

What is this waste called when it comes from the surface of the skin? — "Perspiration."

When does the perspiration flow through the pores of the skin? — "All the time, if the skin is healthy."

Why do we not always see the perspiration which passes through the pores? — "Because it does not always form drops on the surface of the skin; it generally passes off in very fine particles."

What becomes of the fine or minute portions of perspiration which pass from the body? — "Some of these portions are absorbed by the clothing; some pass into and mix with the air around us."

What effect does the perspiration produce on the air and the clothing? — "It soon makes the air unfit to be breathed, and the clothing unfit to be worn."

What is necessary if you would have a healthy skin? [See Formula.]

Why must you wear clean clothing? — "That there may be nothing impure in the clothing for the pores of the skin to absorb."

Why should you breathe pure air? — "Because pure air purifies the blood, and pure blood is necessary to make a healthy skin."

How does drinking alcoholic liquors hurt the skin? — "It makes the blood impure, and impure blood makes unhealthy skin."

In what other way does drinking these liquors hurt the skin? — "It gives the skin too much work to do."

How does it give it too much work to do? — "It makes more waste substance to pass from it through the pores, in the form of perspiration."

In what other way does drinking alcoholic liquors hurt the skin? — "It makes it a bad color."

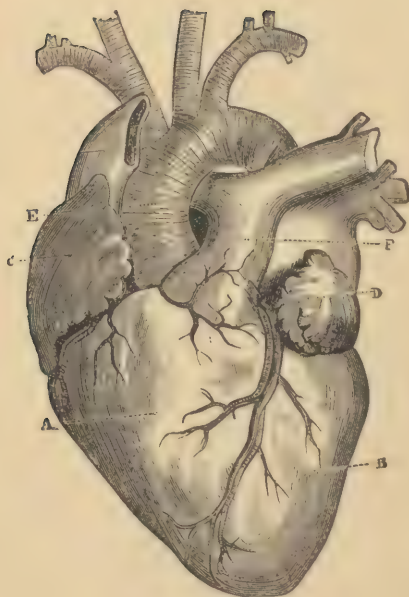
Why does it make the skin a bad color? — "Because it stretches the little blood-vessels of the skin, and makes them too full of blood." See Appendix.

THE SKIN.

BLACKBOARD OUTLINE.

THE SKIN.

POSITION.	CONSISTS OF	QUALITIES.	USE.	RULES FOR HEALTH.
On the surface of the body.	<ol style="list-style-type: none"> 1. The outer or scarf skin,—has no blood-vessels or nerves. 2. The inner or true skin,—is a network of blood-vessels and nerves. 3. The coloring substance,—is different in the different Races of Men. (Perspiratory pores)—about 2000 to a square inch. 	<ol style="list-style-type: none"> Thin. Elastic. Porous. Absorbent. 	<ol style="list-style-type: none"> To cover the flesh. To protect the body. To beautify the body. 	<ol style="list-style-type: none"> I must keep my body clean; I must wear clean clothing; I must eat wholesome food; I must drink wholesome drink; I must exercise in work or play; I must breathe pure air; I must live in the sunlight; I must not drink alcoholic liquors; I must not snuff, smoke, or chew tobacco.



THE HEART.

A, the right ventricle : B, the left ventricle : C, the right auricle
D, the left auricle ; E, the aorta : F, the pulmonary artery.

PART VIII.

THE HEART AND THE CIRCULATION OF THE BLOOD.

The lessons on the Heart and Circulation of the Blood are prefaced by reviewing the Questions on the Introductory Lessons.

1. *The Heart*.—Of what shape is your heart?—“Like a cone.” This question is answered correctly, when we refer the children to the shape of the heart of an ox or calf, which many have seen, or when we show them a picture of this organ on a chart of the Circulatory System.

When the chart is before them they readily see the position of the heart; otherwise, we explain where it is. In either case, they place their hands on the chest, over the heart, when they have learned its position. They try to count how many times the heart beats in a minute, though not often successful in obtaining the correct number of pulsations. We ask, How does your heart beat when you run fast?—“Very fast.” How when you are frightened?—“Very fast.” Then does the heart always beat the same number of times a minute?—“It does not.” We explain that the heart beats very fast when a person is in a high fever, and very slowly in some cases of disease, or extreme weakness; that the heart of a child beats faster than that of an adult, but the usual number of beats is about seventy or seventy-five a minute.

You have already learned that the heart sends or pumps the blood into the arteries. When does the heart pump blood into the arteries?—“Every time it beats.” We tell the class that the heart sends out about two ounces of blood at each beat; then let the children proceed to construct the formula in the usual manner.

2. The Blood.—If you cut your finger what will come out?—“Blood.” How does the blood come out?—“It flows out.” How does it flow out?—“In drops.” What may you say about the blood because it flows in drops?—“It is a liquid.” Of what color is the blood?—“Red.” From what is it made?—“From the food I eat.” Where does it flow from?—“From the heart.” Through what does it flow?—“Through pipes called arteries.” How are these arteries arranged?—“Like the branches of a tree,” the children will tell us, if a chart is used in giving the lesson; without a chart we are obliged to explain about the appearance and arrangement of the arteries, by allusion to the veins on the back of the hand.

What does the blood make?—“Bones, flesh, skin, hair, nails, and cartilage.” When does it make these substances?—“As it flows through the body.” We explain that in making bone and the other materials of the body, the blood gives away its goodness, and thus becomes poor; that the body is constantly wearing out, as they learned in a previous lesson, and the blood does its share in carrying away the waste, bad or impure substances it meets, and thus becomes dark and impure itself, so that it is no longer fit to strengthen and build up the body. What becomes of the bad blood?—“It goes into the veins.” Where do the veins carry it?—“Back to the heart.” Where does the heart send it?—“To the lungs.” What happens to the bad blood in the lungs?—“It is made pure.” What makes it pure?—“Pure air.”

We call upon a child to show us, from the chart, the course of the blood from the heart to the fingers of the right hand; from the fingers back to the heart. Another shows it for the left hand; others show it for the left foot and the right foot. This exercise is repeated until all the class understand the way the blood journeys through the body, “from the heart through the body, back to the heart; from the heart to the lungs and back again to the heart.” We teach them that this way of moving is called *circulation*, and lead them to notice that it requires a double circulation to make one complete circulation of the blood.

If you bind a cord tightly around one of your fingers, how does the finger appear after a short time? — “Dark red.” Why does the finger appear dark red? — “Because the blood does not move fast enough through it.” Why does not the blood move fast enough through it? — “Because the finger is tied up.” What do you tie up in the finger beside bone? — “Flesh and skin.” What pipes are in flesh and in skin? — “Veins and arteries.” Then what are tied up, or pressed upon beside bone, when you tie up your finger? — “Veins and arteries.” What do you think happens when the blood comes to the arteries and veins which have been tied up? — “It is stopped; it cannot flow fast.” Suppose you fasten a belt very tightly around your waist, what do you do to the blood-vessels of the waist, beneath the belt? — “Tie them up; press against them.” Can the blood move as fast as it should when the arteries and veins are pressed against? — “It cannot.”

We explain some of the effects produced by the stoppage of the free circulation of the blood; then ask, How must the blood circulate if you would have a healthy body? — “It must circulate without stopping.” We give the term *freely*. How must your clothing fit, if you do not wish it to stop the circulation of the blood? — “It must fit loosely.”

How does the blood move when you run fast? — “It moves fast.” When you are still? — “It moves slower than when I am running.” Whose blood circulates the most freely, that of a child almost too lazy to move, or that of one who is industrious and quick at work or play? — “That of one who is quick at work or play.” We call upon a child to “exercise” its classmates in moving the hands and arms in various directions, first very slowly, then very rapidly. This leads them to notice the increased heat produced when the body is in action, which, we explain, is caused by the rapid movement of the blood throughout its parts. What do you sometimes see coachmen and car-drivers do in winter when their hands are cold, and they cannot get near a fire to warm themselves? — “They rub their hands; they throw their arms backward and forward across the chest very fast.” Why do they do this? — “To get warm.” How

does this make them warm? — “It makes the blood move faster.” Then why is exercise in work or play of use to the body? — “It makes the blood move fast; it makes the blood circulate freely.”

The efficacy of “rubbing” to warm the body or to soothe pain is explained, and our lesson is concluded with the reading of the formulas which have been constructed and written upon the board during the progress of our conversations about the heart and circulation of the blood.

FORMULA FOR THE LESSON ON THE HEART AND THE CIRCULATION OF THE BLOOD.

1. My heart is shaped like a cone, and placed in my chest near my breastbone, with its apex pointing downward to my left side. It beats about seventy times a minute, sending out about two ounces of blood at every beat.

2. The blood when pure is of a bright red color: it is a liquid made from food and drink.

3. It passes from my heart to all parts of my body, through pipes called arteries; these arteries spread out through the body like branches from a tree.

4. As the blood flows from the heart, through the arteries, it gives nourishment to every part of the body, and carries away the impurities it meets, which makes it black and thick; when it comes through the veins, back to the heart, it is not fit to be used, so it goes to the lungs to be purified by the fresh air; then it returns to the heart to be sent again throughout the body; this happens once, in from three to eight minutes, and is called the circulation of the blood.

7. If I would be healthy,

my blood must be pure and circulate freely all the time.

8. It will not circulate freely,

if I wear tight clothing,

if I do not exercise in work or play,

if I do not keep my body warm.

9. It will be impure,

if I breathe bad air,

if I eat unwholesome food,

if I drink alcoholic liquors,

if I snuff, smoke, or chew tobacco.

QUESTIONS FOR THE FORMULA.

1. Tell about the heart and where it is placed.
2. Tell about the blood and of what it is made.
3. Where does the good blood pass after it is sent out from the heart ?
4. Tell what the blood does as it flows through the body.
5. What is this flowing of the blood to and from the heart called ?
6. How often does it happen ?
7. What is necessary if you would have pure blood ?
8. When will the blood not circulate freely ?
9. When will the blood be impure ?

DIRECTIONS FOR TOUCHING.

The Heart. — In describing the position of the heart, both hands are placed upon the *chest*, and the right hand is used to touch the *left side* and the *breastbone*, as each is named. The same hand is moved back and forth to illustrate the beating of the heart.

The Blood. — As the clause, *it passes from my heart*, is repeated, the children place the right hand upon the *heart*, and move it quickly away as they say, *to all parts of my body*.

The same hand is placed upon the *heart*, each time the latter is named; the hands are crossed upon the chest to show the position of the *lungs*.

QUESTIONS ON THE HEART AND THE CIRCULATION OF THE BLOOD.

Of what shape is your heart ? — “My heart is shaped like a cone.”

Where is it placed ? — “In the chest, pointing toward my left side.”

What bone is it near ? — “It is near my breastbone.”

Of what use is the heart ? — “It contains the blood and sends it to the different parts of the body.”

How much blood is sent from the heart at each beat ? — “About two ounces.”

What is the blood ? — “A liquid made from food and drink.”

Of what color is the blood ? — “Bright red, when pure ; dark red, when impure.”

How does the heart send the blood through the body ? — “Through pipes called arteries.”

What do the arteries resemble in the way they are arranged ? — “The branches of a tree.”

What makes the blood impure ? — “As the blood flows, it gives nourishment to every part of the body : this makes it poor. It also takes up the old worn-out particles ; this makes it impure.”

Where do the arteries carry the impure blood? — "To the veins."

Where do the veins carry the impure blood? — "To the heart."

Where does the heart carry the impure blood? — "To the lungs."

What happens to the impure blood in the lungs? — "It is made pure."

What makes it pure? — "Pure air."

Where do the lungs send the blood after it is made pure? — "Back to the heart."

Where does the heart send the pure blood? — "Throughout the body."

What is the journey of the blood to and from the heart to the different parts of the body called? — "The circulation of the blood."

What is the circulation of the blood? — "The circulation of the blood is its journey from the heart to the different parts of the body, and from the different parts of the body back to the heart."

How often does this circulation take place? — "Once in from three to eight minutes, according as the heart beats fast or slowly."

What kind of blood is necessary to health? — "Pure blood."

How should the blood circulate? — "Freely, all the time."

What do you mean by freely? — "Without anything to hinder."

What is necessary for the free circulation of the blood? — "I must wear clean clothing; I must exercise in work or play; I must keep my body warm."

How does tight clothing hinder the free circulation of the blood? — "By pressing upon the arteries and veins; and when about the waist, causing the ribs and other parts of the body to press upon the heart."

How does exercise help the free circulation of the blood? — "Exercise makes the heart beat faster, which causes the blood to move faster through the arteries and veins."

Why does keeping the body warm help the circulation of the blood? — "Because the blood moves faster when it is warmest: cold chills the blood, and makes it move slowly."

What harm do alcoholic liquors do to the heart? — "They make it tired, and sometimes wear it out."

In what way do they make it tired? — "They make it beat too fast."

Why does it beat too fast? — "Because it is hurrying to drive the alcohol out of the body."

In what other way do alcoholic liquors hurt the heart? — "They produce disease in it."

Tell one way by which the heart becomes diseased through alcoholic liquors? — "Alcohol softens the fibres of the muscles of the heart, and fills them with fat."

What harm does this do to the heart? — "It makes it too weak to do its work, which is to pump the blood through the body."

What sometimes happens when the heart is thus weakened? — "It stops beating, which causes sudden death."

What harm does alcohol do to the blood? — "It uses up the water of the blood; it destroys the goodness of the red part; it makes the blood thin, impure, and unfit to do its work. See Appendices on Alcohol and Tobacco."

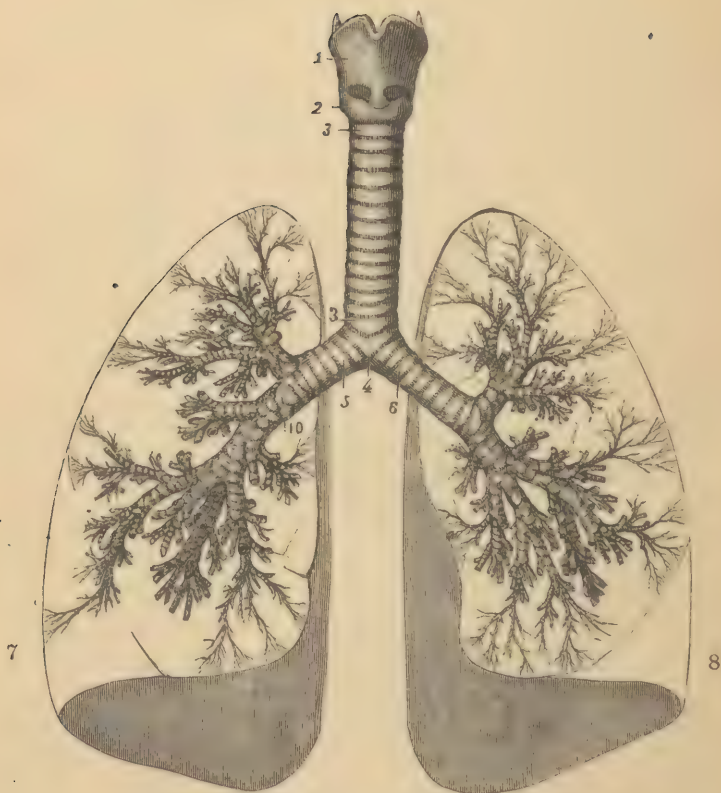
BLACKBOARD OUTLINE.

THE HEART AND THE CIRCULATION OF THE BLOOD.

SHAPE.	POSITION.	BEATS	SENDS OUT	MADE OF	DIVIDED INTO	USE.
Somewhat like a cone.	In the chest, towards the left side, near the breastbone.	About seventy times a minute, as long as we live.	Two ounces of blood at each beat.	Very strong muscles.	Four parts (two auricles and two ventricles), with little doors or valves between them.	To hold the blood, and send it to all parts of the body.

THE BLOOD.

Flows	When?	Made from	Makes	Kinds.	Blood vessels.	Its circulation.	Use.	To have good blood.
From the heart.	Every time the heart beats.	Food and drink.	Bones, Flesh, or, Hair, Nails.	Good blood, Bad blood; Pure blood, Impure blood.	Veins, Arteries, Capillaries.	The veins carry the bad blood to the heart; the heart sends the bad blood to the lungs; in the lungs the air makes the bad blood good; the lungs send the good blood back to the heart; the heart sends the good blood all through the body.	To make the body grow; to keep the body alive.	Eat wholesome food; drink whole-some drink; drink no alcoholic liquors; neither snuff, smoke, nor chew tobacco; breathe pure air; keep the body clean; exercise in work and play.



THE LUNGS.

- | | |
|------------------------------|-------------------------------|
| 1. The windpipe. | 3. The trachea. |
| 5. The right bronchial tube. | 7. Outline of the right lung. |
| 6. The left bronchial tube. | 8. Outline of the left lung. |

PART IX.

THE LUNGS AND RESPIRATION.

1. *Introduction.* — Where does the heart send the impure blood? — “Into the lungs.” Why does the heart send the impure blood into the lungs? — “To be made pure.” What makes the blood pure? — “Pure air.” How does the air get into the lungs? — “Through the nose, mouth, and windpipe.” How many lungs have you? — “Two.” What are they called? — “The right and the left lung.” Where are the lungs placed? — “In the chest.” In which part of the chest? — “In the upper part.”

When convenient, we show the position of the lungs from a chart representing the respiratory system; otherwise, we point to their location in the body. We explain why the chest and armpits, also the back, between and about the shoulder blades, should be well protected by clothing.

The substance and appearance of the lungs are next described, — soft flesh filled with tubes and air-cells, which make them resemble sponge or honey-comb; the children are told that these air-cells and tubes are sometimes closed by disease and become solid, in which case the air cannot pass through them.

2. *The Use of the Lungs.* — We draw upon the blackboard the outline of a common bellows, and call upon the pupils to point out and name its parts, as the handle, the box, and the nose or nozzle; also to explain the use of each. We let them take several long, deep, and full inspirations, and lead them to notice the alternate expansion and contraction of the chest during respiration. To help them understand the process of

breathing, we compare the lungs with the bellows, and show that, as the box of the bellows swells out when the air rushes into it through its nozzle, so the lungs become larger when the air rushes into them, through the nose, mouth, and windpipe, down into the tubes and air-cells; and, as the box of the bellows becomes smaller when its handles are drawn together, and the air rushes out through its nozzle, so the lungs contract and become smaller when the air flows out of the air-cells and tubes, through the windpipe, mouth, and nose, into the atmosphere.

Can you live without breathing? Why not? — “The air will not get into the lungs.” What happens when pure air does not enter the lungs? — “We die.” This is illustrated by referring to the appearance of persons who have been drowned, and asking why we cannot live long under water. — “Because we cannot get air; because the water fills the mouth and throat.” What happens to the blood when we cannot get pure air? — “It is poisoned.” What happens to the body when the blood is poisoned? — “It dies.” Then why must we breathe? — “That the lungs may have pure air to make the blood pure, so that we may not die.”

3. *Hygiene of the Lungs.* — By familiar conversation we obtain from the class nearly all the rules found in the formula for keeping the lungs in a healthy condition.

FORMULA FOR THE LESSON ON THE LUNGS AND RESPIRATION.

1. My lungs are the bellows or breathing machines of my body.
2. They are composed of a soft, fleshy substance, full of small air-cells and tubes. They are porous and spongy when healthy, but in some diseases become an almost solid mass, through which the air cannot pass.
3. I breathe by drawing the air through my windpipe, along the tubes into the cells of my lungs, swelling them out, and causing my chest to expand; then the chest contracts, and the impure vapor in

my lungs is pressed out through the same tubes, windpipe, nose, and mouth, into the atmosphere.

4. I cannot live without breathing, because if the air does not go down into my lungs, the dark blood in them is not changed into pure red blood, and goes back through my body dark blood, which cannot keep me alive.

5. If I would have healthy lungs,
I must breathe pure air,
I must live in the sunlight,
I must keep my body clean,
I must wear loose clothing,
I must wear clean clothing,
I must sit and stand erect,
I must keep all parts of my body warm,
I must not change my winter clothing too early in the spring,
I must avoid draughts of cool air,
I must not rush into the cold when I am in a perspiration,
I must not poison my lungs with alcohol or tobacco.

QUESTIONS FOR THE FORMULA.

1. What are the lungs ?
2. Describe the lungs.
3. How do you breathe ?
4. Why can you not live without breathing ?
5. What is necessary if you would have healthy lungs ?

DIRECTIONS FOR TOUCHING.

The children place the right hand over the *left lung*, and the *heart* ; the left hand over the *right lung*, and both hands over the *chest*, as each is mentioned.

In describing the process of breathing, they touch the *nose* and *mouth* with the right hand, which they also use in pointing to the location of the *windpipe* ; the hands are crossed upon the *chest* to indicate the position of the *lungs* ; both hands are moved outward to illustrate the word "expand," and downward toward the lungs for "contract" ; the *windpipe* is pointed toward, and the *mouth* and *nose* touched, with the right hand, which is also moved backward and forward, to show where the *atmosphere* may be found.

QUESTIONS ON THE LUNGS AND RESPIRATION.

Of what are the lungs composed ? — “Of a soft, fleshy substance, full of small air-cells, and tubes.”

Of what use are the lungs ? — “They are the breathing machines of the body.”

How do the lungs appear when healthy ? — “Porous and spongy.”

How does the air get into the lungs ? — “The air flows through the nose and mouth, into the windpipe and along the air-tubes, into the air-cells of the lungs.”

What does the air do in the lungs ? — “It swells the lungs and causes the chest to expand.”

What do you mean by expand ? — “To increase in size.”

How is the air expelled from the lungs ? — “The chest contracts and sends the impure air through the tubes and windpipe, the nose and mouth, into the atmosphere.”

What do you mean by contracts ? — “Becomes smaller.”

What do you mean by atmosphere ? — “The air.”

Of what use is the air when it is in the lungs ? — “It makes the blood pure.”

Why can you not live without breathing ? — “Because, if I do not breathe, pure air cannot get into the lungs to make the bad blood pure, and I cannot live if the dark, impure blood is sent back again through my body.”

Why must you live in the sunlight ? — “Because the sunlight helps to purify the blood and strengthen the body.”

Why must you wear loose clothing ? — “Because tight clothing stops the circulation of the blood.”

Why must you avoid tight-lacing ? — “Because tight-lacing crowds the ribs against the lungs, so that the lungs cannot move freely.”

Why should you wear clean clothing ? — “That nothing impure may pass into the body through the pores of the skin.”

Why should you keep the body clean ? — “That the pores of the skin may not be closed, but remain open to let the perspiration pass through.”

What has the cleanliness of the body to do with the health of the lungs ? — “If the body is not kept clean, the perspiratory pores become clogged.”

What happens when the perspiratory pores are clogged ? — “The impure particles which should pass through them stay in the body, and cause disease in the lungs or other parts.”

Why should you sit and stand erect ? — “Because, if I am in the habit of stooping, my lungs will be crowded, and will not have enough room to move freely.”

Why should you keep all parts of the body warm ? — “Because chilling any part of the body causes the blood to chill in that part, and thus hinders its circulation.”

Why should you not change your winter clothing too early in the spring of the year ? — “I may take cold if not warmly clothed during the cool days of early spring.”

Why should you avoid draughts of cool air? — “Because the cool air blows upon some parts of the body and closes the pores of the skin, checking the perspiration, and hindering the circulation of the blood.”

Why should you not rush suddenly from a warm to a cool place? — “Because when warm the pores of the skin are open; if I rush suddenly into the cool air, these pores are closed too quickly.”

Why does stopping the perspiration hurt the lungs more or less? — “The impurities it ought to carry away remain in the body, make the blood impure, and produce disease in some part; very often that part is the lungs.”

What harm does alcohol do in the lungs? — “It fills the lungs with impure blood.”

What harm does it do to the air-cells? — “It hardens the walls of the air-cells of the lungs.”

What harm is done by the hardening of these air-cells? — “1. The lungs cannot take in enough of the gas called oxygen to purify the blood perfectly. 2. The gases or vapors in the lungs cannot pass freely through the hardened air-cells.”

What happens from this? — “The lungs become diseased.”

From what disease do some hard drinkers suffer? — “Alcoholic consumption, for which there is no cure.”

BLACKBOARD OUTLINE.

THE LUNGS AND RESPIRATION.

1. THE LUNGS.

I. POSITION.

In the chest, below the collar-bone.

II. QUALITIES OF

A fleshy substance full of air-cells and tubes.

III. QUALITIES.

Porous and spongy.

IV. USE.

To receive air; to hold the blood while it is being made pure.

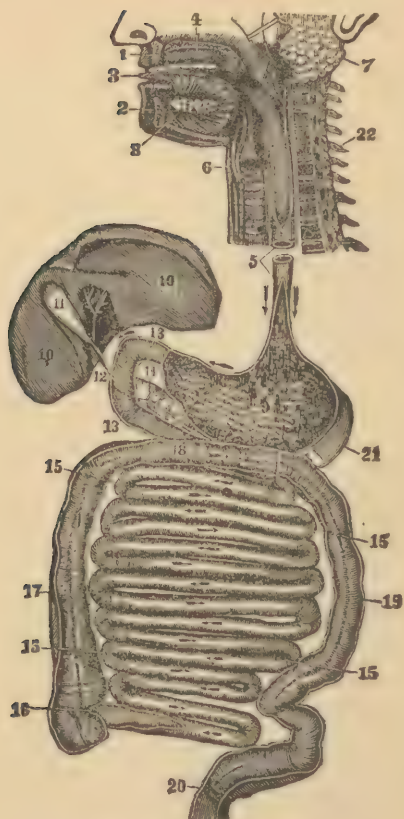
2. RESPIRATION.

HOW WE BREATHE.

See Formula.

RULES FOR HEALTH.

See Formula.



THE DIGESTIVE ORGANS.

- | | |
|---------------------------------|--|
| 1. The upper jaw. | 12. The duct through which the bile passes to the small intestine. |
| 2. The lower jaw. | 13. The upper part of the small intestine. |
| 3. The tongue. | 14. Where the pancreatic juice is made. |
| 4. The roof of the mouth. | 15. The small intestine. |
| 5. The food-pipe. | 16. The opening of the small into the large intestine. |
| 6. The windpipe. | 17-20. The large intestine. |
| 7, 8. Where the saliva is made. | 21. The spleen. |
| 9. The stomach. | 22. The spinal column. |
| 10. The liver. | |
| 11. Where the bile is made. | |

PART X.

THE DIGESTIVE ORGANS AND DIGESTION.

1. *Introduction*.— We refer to the Lesson on the Teeth, and ask, What can you tell about the way you eat? — “When I eat I move my lower jaw only; my tongue brings the food between my teeth; the cutters cut it; the tearers tear it; the grinders grind it; and my tongue helps me to swallow it.” What becomes of the food after it is chewed? — “It goes down the food-pipe; it is rolled by the tongue down the food-pipe.”

2. *The Œsophagus*.— We show the position of the food-pipe, from a diagram on the blackboard, or from a chart of the Digestive Organs; we also tell about the little valve, or fleshy door, which covers the windpipe, to prevent the food-ball from rolling into the latter; and caution the children against speaking or laughing when food or drink is in the mouth. We also explain about the worm-like movement of the Œsophagus during the act of swallowing.

3. *The Stomach*.— To explain the substance of the stomach, we show a piece of tripe, a preparation of the largest stomach of a cow or sheep; to teach about its shape, we point to a representation of this organ on the chart or in a diagram.

The words *extending*, *composed*, *membrane*, and *resembles* are fully explained to the class before they are used in the formula.

4. *The Coats of the Stomach and their Use*.— The outer and inner coats of the stomach are described by reference to the tripe; the outer coat as smooth, thick, and tough; the inner coat as smooth, thick, spongy, and wrinkled. We have no difficulty in explaining about the middle coat. The children

listen eagerly as we talk about its fibres, some placed lengthwise, others circularly, each set having its work to perform in churning the food, pressing upon it, pushing it along as it becomes changed, until, finally, it is sent out of the stomach through the little fleshy door, which is ready to open, when the food is in a proper condition to go through it, into another part of the body sometimes called the *second stomach*.

The words *fibres* and *contracting* are defined by the class from knowledge gained in other lessons.

The use of the first or outer coat of the stomach is illustrated by reference to the outer skin of an orange or other kind of fruit. *Strengthens* and *supports* are defined by the pupils, as they give these words in the construction of the formula.

The use of the delicate, inner coat, in which the liquids which melt the food are made, is next explained. The children know that saliva moistens the food, and when asked how the saliva gets into the mouth, reply, "It comes there." We talk about the glands, where the saliva is made, which always do their work well when healthy and properly used; of the use of the saliva, not only to soften and change the food, but to keep it from hurting the inside of the mouth during the process of chewing.

5. *Mastication and Chyme-making.*—To show that the saliva changes some of the food, we tell the children to take a spoonful of boiled starch, a thick, sticky, and tasteless substance, and hold it in the mouth a short time, then notice how sweet it becomes. Why? Because the saliva has changed the starch into sugar. As soon as the use of the saliva is understood, we proceed to explain that the food, when it reaches the stomach, finds a slimy substance, which keeps it from irritating the thin, delicate, inner skin; and a kind of fluid, called *gastric juice*, by which it is changed and dissolved.

Our talk of the use of the gastric juice is somewhat as follows:—If it were possible to have a window made in your chest, so that you could look into your stomach, how surprised you would be to find the meat, potatoes, bread, or whatever you may have put into it, so mixed together and changed you

could not distinguish them from each other. What has done this? The gastric juice has been at work, doing for the food what water does to salt or sugar, *i.e.*, has melted it; or, as grown people would say, "The gastric juice has dissolved the food." What shall we say the gastric juice does to the food? — "It melts the food; it dissolves the food."

The inner coat of the stomach prepares the slimy substance and the gastric juice to act upon the food in the stomach, as the salivary glands in the mouth prepare the saliva to moisten and change the food put into the mouth. By what is the food changed after it enters the mouth? — "By the teeth; by the saliva." How does it appear? — "Soft and wet." What do you call the soft part of an orange? — "Pulp." The same name is given to the food after it has been chewed, and the work of chewing is called *mastication*, — a long word, but one you can easily remember.

What changes the food in the stomach? — "The gastric juice." What presses upon it and pushes it along? — "The fibres of the middle coat." Yes, these fibres work somewhat as the teeth and tongue do in the mouth, moving the food in the stomach and changing it into another pulp, to which we give a queer name, *chyme*, pronounced as though it were spelled *kime*; the work which the stomach does to the food is called *chymification* or *chyme-making*.

6. Chyle-making. — In explaining about the intestines, we use a chart, or picture, and tell the children that the queer-looking, coiled, cylinder-like organ is divided into two parts, the small intestine, sometimes called the second stomach, and the large intestine; the former twenty-five, and the latter five feet in length. No wonder you ache after you have eaten unripe fruit or any unwholesome food, when it must travel thirty feet, or ten yards, to get out of the body, after it leaves the stomach.

In this strange part of the body the chyme is changed by two kinds of liquid, one of which is called *pancreatic juice*, the other, *bile*, a yellowish fluid, with a bitter, unpleasant taste, which sometimes makes you suffer by getting into your stomach, giv-

ing you no ease till it is removed. In the small intestine, that portion of the chyme which will make good blood is separated from the good-for-nothing part, or waste. What do you do with waste things?—"Throw them away." So your body throws away the waste portion of the chyme, or changed food, through the opening at the lower end of the large intestine; and you must be careful to have this done regularly, every day, if you do not wish to suffer from ill-health.

The good part of the chyme will help to make the body grow, so we call it the nourishing part, and give it a name so nearly like chyme that you will surely make a mistake, if you are not careful to remember it is *chyle*. Can you tell, from what you have learned, which is made first, the chyle or the chyme?—"The *chyme*." Which letters are alike in the name?—"The first three, *c-h-y*, and the last, *e*." Which is different?—"The next to the last; one name has an *m*, the other has an *l* in it." Which has the *l*, the name of that made in the small intestine, or that which is made in the stomach?—"That which is made in the intestines." What letter begins the word *last*?—"l." What letter in the word *chyle* is different from the letters in the word *chyme*?—"l." Then what will help you to remember which is made in the small intestine, chyme or chyle?—"I can remember that the word which has an *l* in it is the name of that which is made last." What is made in the stomach?—"Chyme." What is made in the small intestine?—"Chyle."

7. Blood-making.—But the chyle cannot make bones, flesh, skin, nails, hair, or cartilage; into what, then, must it be changed?—"Into blood." How this change of chyle into blood is made nobody knows but the great and wise God, who made us and keeps us alive. We only know that the chyle finds its way into a large vein back of the collar bone, and flows into the lungs, where it meets with the air, and by and by reaches the heart, good, red blood, fit to be used in building and strengthening the body.

In familiar conversation about food and the manner of eating, we draw from the children the simple but important hygienic

rules with which we conclude our lessons on the Digestive Organs and the Process of Digestion. These rules are repeated at the close of the formulas which have been prepared during the progress of the lessons.

FORMULA FOR THE DIGESTIVE ORGANS AND DIGESTION.

1. When my food is chewed, it is rolled by my tongue into the œsophagus, or food-pipe, which is back of my windpipe, and leads from my mouth down along the side of my spine, to the left and upper end of my stomach.

2. My stomach is an oblong, soft, and fleshy bag, extending from my left to my right side, below my lungs and heart.

3. It is composed of three coats or membranes, and resembles tripe.

4. The *outer coat* is smooth, thick, and tough. It supports and strengthens the stomach.

5. The *middle coat* is fibrous. Its fibres have the power of contracting, sometimes pressing upon the food, and sometimes pushing it along toward the opening which leads out of the stomach.

6. The *inner coat* is soft, thick, spongy, and wrinkled. It prepares a slimy substance and a fluid. The slimy substance prevents the stomach from being irritated by the food.

7. Food passes through several changes after it enters the mouth.

8. It is changed into pulp in the *mouth*, by the action of the teeth and the saliva. This is called *mastication*. It is changed in the *stomach*, by the action of the stomach and the gastric juice, into another kind of pulp called *chyme*. The chyme is changed by the bile and another kind of juice, called *pancreatic juice*; these separate the nourishing from the waste substance. The nourishing, milk-like substance is called *chyle*. The waste substance passes from the body. The chyle is poured into a vein behind the collar bone, and passes through the heart to the lungs, where it is changed into blood.

9. If I would have a healthy stomach,

I must be careful what kind of food I eat,

I must be careful how much I eat,

I must be careful how I eat,

I must be careful when I eat.

10. I must eat wholesome food, good bread, ripe fruits, rather than rich pies or jellies.
11. I must eat enough food, but not too much.
12. I must eat slowly,
I must masticate my food thoroughly,
I must masticate and swallow my food without drinking.
13. I must take my food regularly but not too often,
I must rest before and after eating, if possible,
I must not eat just before bedtime.
14. I must breathe pure air,
I must sit, stand, and walk erect,
I must not drink alcoholic liquors,
I must not snuff, smoke, or chew tobacco.

QUESTIONS FOR THE FORMULA.

1. Describe the process of eating.* See page 50.
2. Where does the food go after it is chewed ?
3. Describe the stomach.
4. Of what is the stomach composed ?
5. Describe the outer coat of the stomach, and tell its use.
6. Describe the middle coat of the stomach, and tell its use.
7. Describe the inner coat of the stomach, and tell its use.
8. What happens to the food after it enters the mouth ?
9. Tell about these changes.
10. What is necessary if you would have a healthy stomach ?
11. What kind of food must you eat ?
12. How much food must you eat ?
13. How must you eat ?
14. When must you eat ?
15. What other rules must you obey ?

DIRECTIONS FOR TOUCHING.

The position of the *oesophagus* is indicated by passing the right hand from the *mouth* down the side of the *spine*, then to the left and upper end of the *stomach*. The position of the *stomach* by passing the same hand from the *left* to the *right side*, and laying it upon the *heart*, then crossing the hands over the *lungs*.

* See Formulas on the Organ of Sense.

QUESTIONS ON THE DIGESTIVE ORGANS AND DIGESTION.

What happens to the food after it is chewed? — "It is rolled by my tongue into the œsophagus or food-pipe."

Where is the œsophagus or food-pipe? — "It passes from the mouth down the left side of the spine."

What is the stomach? — "A fleshy bag which receives and changes the food we eat."

Where is the stomach? — "In the front part of the chest, below the heart and lungs."

Of what is the stomach composed? — "Of three coats or membranes."

What do you mean by composed? — "Made of."

What do you mean by membrane? — "A thin skin."

What are the coats of the stomach called? — "The outer coat, the middle coat, the inner coat."

Describe the outer coat of the stomach. — "The outer coat is smooth, thick, and tough."

Of what use is the outer coat of the stomach? — "It strengthens and supports the stomach."

What do you mean by supports? — "Holds."

Describe the middle coat of the stomach. — "The middle coat is composed of fleshy fibres, which have the power of making themselves long or short."

What do you mean by fibrous? — "Composed of threads."

What do you mean by fibres? — "Threads."

Of what are the fibres of the stomach composed? — "Of flesh."

Of what use are the fibres of the stomach? — "They press upon the food, and push it toward the opening which leads out of the stomach."

Describe the inner coat of the stomach. — "The inner coat is soft, thick, spongy, and wrinkled."

Of what use is the inner coat of the stomach? — "It prepares a slimy substance and a fluid."

Of what use is the slimy substance? — "It prevents the stomach from being irritated by the food."

Of what use is the fluid? — "It dissolves the food."

What do you mean by slimy? — "Soft, moist, and sticky."

What do you mean by irritate? — "To produce unhealthy action."

What do you mean by dissolves? — "Melts."

Where is the food changed after it is taken into the mouth? — "First, it is changed in the mouth; second, it is changed in the stomach; third, it is changed after leaving the stomach; fourth, it is changed in the lungs."

By what is it changed in the mouth? — "By the action of the teeth and the saliva."

By what is it changed in the stomach? — "By the action of the stomach and a kind of fluid called gastric juice."

By what is it changed after leaving the stomach? — "By the action of the bile and the pancreatic juice."

By what is it changed in the lungs? — "Nobody knows."

Into what is it changed in the mouth ? — “ Into pulp.”

Into what is it changed after leaving the stomach ? — “ Into chyle and waste substance.”

Into what is it changed in the lungs ? — “ Into blood.”

What is the change in the mouth called ? — “ Mastication, or chewing.”

What is the change in the stomach called ? — “ Chymification, or chyme-making.”

What is the change after leaving the stomach called ? — “ Chylification, or chyle-making.”

What is necessary if you would have a healthy stomach ? — “ I must be careful what kind of food I eat : how much I eat ; and when I eat.”

What kind of food must you eat ? — “ Wholesome food,” etc. See Formula.

How much must you eat ? — “ Enough, but not too much.”

How must you eat ? — “ Slowly.”

How should your food be masticated ? — “ Thoroughly.”

When must you eat ? — “ Regularly, but not too often.”

When should you avoid eating ? — “ Just before bedtime.”

What kind of air should you breathe ? — “ Pure air.”

How should you sit, stand, and walk ? — “ Erect.”

Why should you not eat too much food ? — “ Because, if I eat too much food, my stomach will have too much work to do in changing it into chyme.”

Why should you eat slowly ? — “ That I may have time to masticate the food thoroughly.”

Why should you masticate your food thoroughly ? — “ That it may be well prepared to enter the stomach.”

Why should the food be well prepared to enter the stomach ? — “ Because, if it is not well prepared in the mouth, the stomach will have too much work to change it into chyme.”

Why should you eat regularly, but not too often ? — “ Because the stomach needs rest, which it cannot have, if I eat too often.”

Why should you avoid eating just before bedtime ? — “ Because, while I am asleep the stomach cannot do the work of changing the food as it ought to be changed ; because the stomach should rest with the other parts of the body.”

Why should you breathe pure air ? — “ Because pure air helps to make pure blood, which the stomach needs to make it strong and healthy.”

Why should you sit, stand, and walk erect ? — “ That the stomach may not be crowded out of its place, or pressed upon by other parts of the body.”

In what way does tobacco hurt the stomach ? — “ It poisons the saliva and prevents it from preparing the food to enter the stomach.”

What harm does tobacco do inside the stomach ? — “ It weakens the stomach and makes it unfit to change the food into chyme.”

How will wise children treat tobacco ? — “ Let it alone. They will not chew, snuff, or smoke the vile weed.”

Is alcohol food or poison ? — “ It is poison.”

How do we know it is not food ? — “ Because it cannot be changed into blood.”

How has this been proved? — “Alcohol has been found in the brain, and other parts of drunkards, with the same smell and the same power to burn easily which it had when it was taken into the mouth.”

How do you know it is a poison? — “Because it does harm to every part of the body, beginning in the stomach.”

What harm does alcohol do in the stomach? — “It hinders the stomach from doing its work; it burns the coats of the stomach; it destroys the gastric juice; it hardens the food, so that it cannot be dissolved by the gastric juice.”

What does the stomach do with alcohol? — “Drives it out as soon as possible.”

Where does the stomach send it? — “Into the liver.”

Where does the liver send it? — “To the heart; and the heart sends it to the lungs.”

What do the lungs do with the alcohol? — “They drive it out as soon as they can.”

Where do the lungs send some of it? — “Through the nose and mouth, into the air.”

What harm does the alcohol do in the breath? — “It poisons the air; it tells that some kind of alcoholic liquor has been taken into the stomach.”

From what you have learned about alcohol, what do you think is the only safe rule to obey concerning cider, beer, wine, and all alcoholic liquors? — “I must not drink them if I wish to have a strong and healthy stomach.”

1. THE STOMACH.

POSITION.	SHAPE.	COMPOSED OF
In the chest, below the heart and the lungs.	Oblong and baglike.	Three coats or membranes, viz., the outer coat, the middle coat, the inner coat.

2. THE COATS OF THE STOMACH.

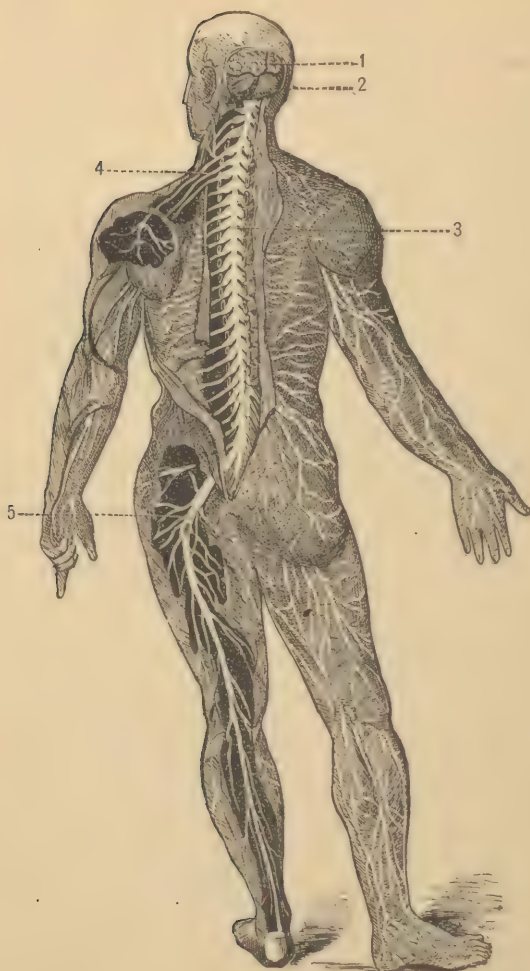
NAMES.	DESCRIPTION.	USE.
The outer coat.	Smooth, thick, and tough.	Supports and strengthens the stomach.
The middle coat.	Fibrous.	Presses upon and pushes the food along.
The inner coat.	Soft, thick, spongy, and wrinkled.	Prepares a slimy substance, and a fluid called <i>gastric juice</i> .

3. THE PROCESS OF DIGESTION.

WHERE?	BY THE	INTO	CALLED
1. In the <i>mouth</i> .	Teeth and the saliva.	Pulp.	Chewing or <i>masticating</i> .
2. In the <i>stomach</i> .	Middle coat and the gastric juice.	Chyme.	Chyme-making or <i>chymification</i> .
3. After <i>leaving the stomach</i> .	Bile and the pancreatic juice. (We know not how.)	Chyle and waste.	Chyle-making or <i>chylification</i> .
4. In or near the lungs.		Blood.	Blood-making or <i>sanguification</i> .

4. RULES FOR HEALTH.

I MUST BE CAREFUL		
WHAT I EAT OR DRINK.	HOW MUCH I EAT.	WHEN I EAT.
Wholesome food: not rich pies, jellies, etc.	Enough, but not too much.	Regularly.
Wholesome drink: not anything with alcohol in it.		Not too often.
		Not just before bedtime.



—(From Walker's *Physiology*, 1884.)

THE NERVOUS SYSTEM.

- | | |
|---------------------|---------------------|
| 1. The large brain. | 3. The spinal cord. |
| 2. The small brain. | 4, 5. Nerves. |

PART XI.

THE NERVOUS SYSTEM.

Introduction. — What is your mind? — “My mind is that part of me which thinks, remembers, reasons, and wills.” In what part of your body is your mind supposed to be? — “In my head.” Why do you think your mind is not in your hands or feet? — “Because if my hands and feet were taken off I could still continue to think.” What do you call the part of the head where the mind is supposed to be? — “The brain.” What covers the brain? — “The skull.” Of what use is the skull? — “It holds the brain; it protects the brain.”

The Brain. — A chart of the Nervous System, or a picture representing the brain, is shown to the children, who are told that the brain is divided into two unequal parts, which may be called the large brain and the small brain; that these parts are divided into halves, alike in shape, so that we have a pair of brains, just as we have a pair of eyes and a pair of ears.

How many of you have seen marrow? Well, when you see marrow, remember that it looks very much like the substance of which your brain is composed. Sometime you may see a pig’s brain; that will give you a very good idea of the appearance of your own brains. The brain of a grown person is about six inches long, five inches wide, and four inches thick. Arteries and veins run through it in every direction, for it has a great deal of work to do, and needs a great quantity of blood to nourish and strengthen it.

The brain is covered and held together by three coats of skin, called *membranes*; the outer coat supports it, and makes it strong, and is therefore thick and firm; the middle membrane, which is very thin, resembles a spider’s web; and the inner membrane is a network of blood-vessels.

The Nerves. — How many of you have had a toothache? How many have heard about the nerve of a tooth? We stop to hear what the class has to say about nerves, and talk about *neuralgia*, as pain of the nerves, or *nerves suffering*; then proceed to explain the subject more fully, somewhat as follows: If you could look at your brain, you would see white or reddish-gray cords of flesh passing through it; these are soft and pulpy; they are the nerves which give you so much trouble when you suffer from neuralgia. But do not wish you had no nerves, for, though they do torment you, you could not live if you had none. Suppose you were to place your hand accidentally upon a hot iron, what would you feel? — “Pain.” What would you do? — “Move my hand away from the iron.” How would you know the iron was hot? — “By the sense of feeling, or touch.” We explain that it is the *nerves* which enable them to have the sense of feeling, and prompts the removal of the hand as soon as the pain is felt.

How many of you have seen the telegraph wires? Of what use are they? — “To carry messages from one place to another.” We converse with the children about the telegraph machine and the way telegraphing is done: then, by comparing the brain to the machine, and the nerves to the wires, help the attentive listeners to understand something of the work of the nervous system in carrying news to the mind.

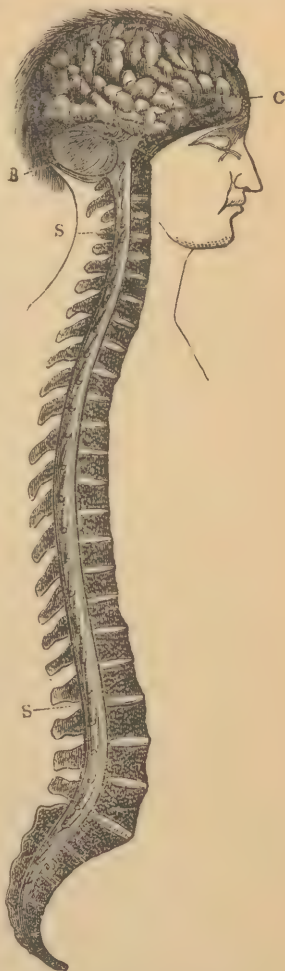
The Kinds of Nerves. — We further explain that there are *two kinds of nerves*, — one which causes us to feel, the other which causes the muscles to move; thus, when the hand is placed on a hot iron, a *nerve of feeling* carries the message to the brain quicker than lightning, and the brain as quickly sends back word through the *nerves of motion*, which causes the hand to draw itself away from the heated substance. Two anecdotes also help to illustrate the use of the nerves. A gentleman who was suffering from brain and spinal disease lost the power of feeling in his lower limbs. His physician upon one occasion directed him to use a warm foot-bath. He obeyed, and was surprised, when he removed his feet from the water, to

find them completely blistered. The water was boiling hot, but he did not know it until he saw its effect, because the nerves of feeling in his feet had not sent any message of pain to his brain.

A lady had a stroke of paralysis which affected her very strangely. Upon one side the nerves of feeling were destroyed; on the other the nerves of motion had lost their power. She could carry her child upon one arm, but could not know it was there without keeping her eye upon it; while, if it were placed on the other arm, she could feel its presence, but could not move it.

From these illustrations the children are able to explain why they *feel* pain when they prick their finger with a pin, and what causes them to move the finger in obedience to their will.

The Spinal Cord.—Where is your spine?—"My spine extends from the base of my skull, behind, down the middle of my back." Of what is the spine composed?—"It is composed of about twenty-four short bones, piled one upon the other, with cartilage between them." After receiving these replies from those who have studied the lesson on the "Description of the Bones," we proceed to explain that the spine is also called the *spinal column*; that the bones of which it is composed are hollow, and through them a bundle of nerves, called the *spinal cord*, passes



THE SPINAL CORD.

C, the large brain (cerebrum);
B, the little brain (cerebellum); S, the spinal cord.

from the base of the brain down the whole length of the spine ; that the thirty-one pairs of nerves pass from this spinal cord to different parts of the body.

The Brain Nerves. — Next we tell the children about the pairs of nerves which proceed from the brain, and describe the work of each ; as, the first pair pass to the nose, and tell the mind about the odor of things, whether pleasant or disagreeable, and are called the *nerves of smell* ; the second pair pass to the eyes, and send news to the brain concerning the appearance of objects, and are called the *nerves of sight* ; the third, fourth, and sixth pairs move the muscles of the eyes ; the fifth pair are divided into three branches, the first passing to the forehead, eyes, and nose ; the second to the eyes, the teeth of the upper jaw, and different parts of the face ; the third branch to the ear, the tongue, and the muscles and teeth of the lower jaw ; the seventh pair to different parts of the face ; the eighth pair, called the *nerves of hearing*, to the ears ; the ninth pair to the mouth, tongue, and throat ; the twelfth pair to the tongue ; the eleventh pair to the neck ; and the tenth pair to the neck, throat, lungs, stomach, and other different parts of the body.

Conclusion. — The effect produced by destroying a nerve, also, by pressing upon it, is explained. See Formula for this part of the lesson. Lastly, we talk of what the brain needs. — pure blood, work, and rest, either in sleep or by change of employment.

Directions for Recitations. — When each portion of the Formula which has been constructed during the progress of the lesson is perfectly memorized, the whole is repeated with appropriate gestures. See Directions for Touching.

FORMULA FOR THE LESSON ON THE NERVOUS SYSTEM.

1. My brain is a soft gray-and-white mass resembling marrow.
2. It is placed in a bony box called the skull ; it is covered and held together by three coats or membranes.

3. The outer membrane is thick and firm ; it strengthens and supports the brain.

4. The middle membrane is thick, and somewhat like a spider's web in appearance.

5. The inner membrane is a network of blood-vessels.

6. From the brain, white or reddish gray pulpy cords, called nerves, pass to all parts of the body. These nerves are of two kinds : nerves of feeling, and nerves of motion.

7. If I prick my finger, a nerve of feeling carries the message to my brain ; if I wish to move my finger, a nerve of motion causes my finger to obey my will.

8. Twelve pairs of nerves pass from the base of the brain : the first pair, called the nerves of smell, to my nose : the fourth pair, called the nerves of sight, to my eyes ; the fifth pair, called the nerves of taste, to my mouth, tongue, and teeth. One pair pass to my face ; another to my ears. The ninth, tenth, eleventh, and twelfth pairs to my tongue and parts of my throat and neck.¹

9. The spinal cord is a bundle of nerves extending from the base of my brain, down through the whole length of my spine, or backbone. It is the largest nerve in my body.

10. From the spine, thirty-one pairs of nerves, called *spinal nerves*, pass to different parts of my body ; some to the lungs, some to the heart, some to the stomach, some to the bones, and some to the muscles and skin.

11. If a nerve be destroyed it cannot carry messages to and from the brain. Before filling a tooth, the dentist sometimes destroys its nerve.

12. If a nerve be pressed upon too long it cannot perform its duty. If I press upon the nerve passing to my foot, I stop it from communicating with the brain ; the foot loses its feeling, or, as I say, "is asleep."

¹ NOTE. — *A fuller description of the Nerves of the Brain* : Twelve pairs of nerves pass from the base of the brain ; the first pair, called the nerves of smell, to my nose ; the second pair, called the nerves of sight, to my eyes ; the third, fourth, and sixth pairs to the muscles of my eyes ; the fifth pair to my forehead, eyes, nose, ears, tongue, teeth, and different parts of my face ; the seventh pair to different parts of my face ; the eighth pair, called the nerves of hearing, to the inner part of my ear ; the ninth pair to my mouth, tongue, and throat ; the twelfth pair to my tongue ; the eleventh pair to my neck ; the tenth pair to my neck, throat, lungs, stomach, and different parts of my body.

13. If I drink alcoholic liquors, or snuff, smoke, or chew tobacco, my brain and nerves cannot do their work well; because alcohol and nicotine are very poisonous to the brain and nerves.

14. The brain must be supplied with good blood;

The brain must be used;

The brain must be rested;

I must drink wholesome drink, eat wholesome food, take enough exercise, and breathe pure air, that my brain may be supplied with pure blood;

I must study and think, that my brain may grow and be strong for work;

I must rest my brain when it is tired, either by changing my employment, or by going to sleep;

I must not poison my brain with alcohol or tobacco.

QUESTIONS ON THE FORMULA.

1. Describe the brain.
2. Where is the brain placed?
3. Describe the outer membrane of the brain.
4. Describe the middle membrane of the brain.
5. Describe the inner membrane of the brain.
6. Tell about the nerves.
7. Tell about the use of the two kinds of nerves.
8. Tell about the nerves which pass from the brain.
9. Tell about the spinal cord.
10. Tell about the nerves which pass from the spinal cord.
11. What happens if a nerve be destroyed?
12. What happens if a nerve be pressed upon too long?
13. What happens if you drink alcoholic liquors, or snuff, smoke, or chew tobacco?
14. What is necessary if you would have a healthy brain?

DIRECTIONS FOR TOUCHING.

The *skull* is touched with both hands when it is named. The children prick the *left forefinger* with a pin, in describing the use of the nerves of feeling, and move the *right forefinger* forward and backward in showing that of the nerves of motion. They indicate the position of the spinal cord by passing the right hand from the *base of the brain* down the length of the *spine*.

In describing the nerves which pass from the brain, they touch the *base of the brain* with the right hand, and the *nose* with the same hand;

pass the right hand down the *face*, and place a hand upon each *ear*; then point to the *tongue* with the tip of the right finger, and pass the hands around the *neck* and *throat* as the nerves of these various parts are mentioned.¹

In telling about the spinal nerves, the hands are crossed over the *lungs*, and the right hand is placed upon the *heart* and over the *stomach*, as each of these organs is named.

QUESTIONS ON THE NERVOUS SYSTEM.

Where is your brain? — “In my skull.”

What color is the brain? — “Gray and white.”

What does the brain resemble? — “Marrow.”

How is the brain protected? — “By three coats or membranes.”

What may you name these membranes? — “The outer membrane, the middle membrane, and the inner membrane.”

Describe the outer membrane. See Formula.

Describe the middle membrane. See Formula.

What are the nerves? — “White ashen-gray pulpy cords, which are found in the brain.”

Where do they go from the brain? — “To every part of the body.”

How many kinds of nerves have you? — “Two.”

What names are given to the two kinds of nerves? — “Nerves of motion and nerves of feeling.”

Which is the largest nerve in the body? — “The spinal cord.”

Where is the spinal cord? — “It extends from the brain throughout the whole length of the backbone.”

How may you describe the spinal cord? — “It is a bundle of nerves,” etc. See Formula.

Where are the spinal nerves? — “They pass from the spinal cord to different parts of the trunk and limbs.”

How many pairs of nerves pass from the base of the brain? — “Twelve.”

Where do the first pair go? — “To the nose.”

What are they called? — “The nerves of smell.”

Where do the second pair go? — “To the eyes.”

What are the second pair called? — “The nerves of sight.”

¹ NOTE.— *When the fuller description of these nerves is used:* For the first pair touch the nose with the right hand; for the second pair touch the eyes with both hands; for the third, fourth, and sixth pairs touch the eyes with both hands; for the fifth pair point to the forehead, eyes and ears, tongue and teeth, and touch the whole face with both hands; for the seventh pair touch the face with both hands; for the eighth pair touch the ears with both hands; for the ninth pair point to the mouth, tongue, and throat with the right hand; for the twelfth pair point to the tongue with the right forefinger; for the eleventh pair touch the neck with both hands; for the tenth pair point to the neck, throat, lungs, stomach, and whole body with both hands.

Which move the muscles of the eyes? — “The third, fourth, and sixth pairs.”

Where do the fifth pair go? — “To the forehead, eyes, nose, ears, tongue, teeth, and different parts of the face.”

The seventh pair? — “To the different parts of the face.”

The eighth pair? — “To the inner ear.”

What are the eighth pair called? — “The nerves of hearing.”

Where do the ninth pair go? — “To the mouth, tongue, and throat.”

Where do the twelfth pair go? — “To the tongue.”

Where do the eleventh pair go? — “To the neck.”

Where do the tenth pair go? — “To the neck, throat, lungs, stomach, and different parts of the body.”

What happens if a nerve be destroyed? — “It cannot carry messages to the brain.”

What happens if a nerve be pressed upon too long? — “It cannot carry messages to the brain.”

What is necessary if you would have a strong, healthy brain? — “My brain must be used; my brain must be rested; my brain must be supplied with pure blood.”

How must you use your brain? — “In thinking and studying.”

How may the brain be rested? — “By sleep.”

In what other way may the brain be rested? — “By thinking of something different from that which made it tired.”

What two brain-poisons have you learned about? — “Alcohol and tobacco.”

With what may you show the harm done by alcohol to the gray part of the brain? — “With alcohol and the white of an egg.”

How could you show it with these? — “I would pour the alcohol upon the white of the egg.”

What would then happen? — “The white of the egg would harden as if it had been boiled.”

What is in the white of an egg? — “Water and albumen.”

Where else may we find albumen? — “In some seeds, and in the gray part of the brain and the nerves.”

What harm does alcohol do to the nerves? — “It takes away their moisture and hardens them.”

What harm does this do to them? — “It paralyzes them, or makes them lose their power.”

What happens when nerves are paralyzed? — “They lose their power over the muscles; they are unfit to carry messages to and from the brain.”

What harm does alcohol do to the gray part of the brain? — “It hardens it, as it hardens the white of an egg.”

What harm does this do to the brain? — “It paralyzes it, or makes it lose its power.”

What then happens? — “It cannot properly do its work of thinking, and cannot control the nerves.”

What disease is sometimes caused by this hardening of the brain by alcohol? — “Paralysis, which often ends in death.”

What harm does alcohol do to the blood-vessels of the brain? — “It fills them with impure blood.”

What disease is caused by the blood-vessels of the brain being filled with impure blood? — “Congestion of the brain, or apoplexy, which ends in death.”

What else frequently happens to those who drink alcoholic liquors? — “They become crazy, or insane.”

If you wish to have a strong, healthy brain, what should you do about these liquors? —

“Never put them into my mouth,
To steal away my brains.”

Tell of what dreadful disease people die who are bitten by a mad dog. — “Of hydrophobia.”

Of what dreadful disease do people sometimes die who are bitten by the serpent in alcoholic liquors? — “Of delirium tremens.”

Which is the more dreadful, hydrophobia or delirium tremens? — “One is as dreadful as the other.”

How can you be sure never to have delirium tremens? — “By drinking nothing which has alcohol in it.”

Will a little beer or wine hurt you? — “Yes, it may make me love the taste of alcohol.”

What harm is there in loving the taste of alcohol? — “I may love it so much as to become a drunkard.”

Tell once more how you should treat alcoholic liquors. — “I should never drink a drop of them.”

For questions on TOBACCO, see Appendix II.

BLACKBOARD OUTLINE.

A. THE NERVOUS SYSTEM.

I. INCLUDES	II. PLACE.	III. COMPOSED OF		IV. USE.
		Three coats or membranes.	Fleshy, grayish-white cords.	
The brain and nerves.	In the skull. In the brain and throughout the body.			Supposed to be the part of the body in which the mind thinks. To carry messages to and from the brain.

B. THE COATS OF THE BRAIN.

I. NAME.	II. DESCRIPTION.	III. USE.
The outer coat.	Thick and firm.	To strengthen and support the rest of the brain.
The middle coat.	Thin and web like.	
The inner coat.	A net-work of blood-vessels.	To contain the blood.

C. THE NERVES.

KINDS.	I. NAME.	II. NUMBER.	III. WHERE GO.
Of feeling, — to see, feel, smell, taste, and hear through.	Nerves of the brain.	Twelve pairs.	To the head, face, and neck.
Of motion, — to cause the body to obey the mind.	Nerves of the spine.	Thirty-one pairs.	To the heart, lungs, stomach, and different parts of the body.

D. THE SPINAL CORD.

I. PROCEEDS FROM	II. CONSISTS OF	III. THE SPINAL NERVES.
The brain through the whole length of the spine.	Thirty-one pairs of nerves, called <i>spinal nerves</i> .	To the lungs, the heart, the stomach, the bones, and the muscles of the trunk and limbs.

RULES FOR HEALTH.

- The brain must be used.
- The brain must be rested.
- The brain must be supplied with good blood.
- The brain must not be poisoned with alcohol or tobacco.

APPENDIX I.

ALCOHOL AND ALCOHOLIC LIQUORS.

ALCOHOL.

THE STORY ABOUT ALCOHOL.

SEVERAL hundred years ago many people were trying to discover something that would keep them young and strong, and prevent them from dying. It is said by some that a man named Paracelsus, in making experiments, discovered *alcohol*. He called it "the water of life," and boasted that he would never be weak and never die; so he went on drinking alcoholic liquors until at last he died in a drunken fit.

What is this alcohol which has done and is doing so much mischief in the world? I will show you some. What does it look like?—"Water." Yes; and if you were to smell it you would say it has a somewhat pleasant odor; if you were to taste it, that it has a hot, biting taste, *i.e.*, is pungent. If you put a lighted match to it you would notice that it burns easily, and with a flame, and may therefore be said to be combustible and inflammable.

What does it come from? Is it one of the drinks God has given us? Some of the class think it is; we will try to learn whether this answer is correct or not. If we study about it very carefully we shall discover that it is not a natural drink, that it is not found except where it has been made from decayed or rotten fruits, grains, or vegetables.

If you take some apples, and squeeze the juice out of them, you will find it sweet and pleasant; let that juice stand for several days and what will happen to it?—"It will get bad." Yes; or, as grown people say, it will *work* or *ferment*; that is, the sugary part of the juice will be separated into a kind of gas and a liquid. The gas is called *carbonic acid gas*; the liquid is *alcohol*. Both the gas and the liquid are poisonous.

Alcohol may also be obtained from other fruits, as grapes, and from some grains and vegetables. But all these must first become rotten before alcohol will come out of them. This is

one reason why we think that God, who gives us good, wholesome food, did not intend alcohol to be a drink for man, else He would have put it into the delicious ripe fruit, and not made it impossible to get until they decay.

Now let us put upon the blackboard something which will help us remember what we have learned about

ALCOHOL.

DISCOVERED BY	DESCRIPTION.	MADE FROM
Paracelsus.	Water-like; with a pleasant odor; a hot, biting taste; and will burn with a flame.	Rotten { Fruits, Grains, or Vegetables.
CALLED		
"The water of life."		

USES OF ALCOHOL.

WE put some sugar into water; the children see that it melts; then some glue or shellac is placed in the same liquid; they see that this is not melted, but that, when alcohol is used instead of water, the glue or shellac is dissolved. From this experiment they learn that alcohol is used in making varnishes.

Some water is poured into one saucer, and alcohol into another; a lighted match is applied to each; the class notices that the alcohol takes fire and burns, while the water does not.

Next, we fill a lamp with alcohol, and put a wick into it; when the wick becomes wet with the fluid it burns steadily and without smoke, as may be seen by holding a clean white saucer over the flame. This shows why jewellers and others, who wish to use a lamp to make things very hot, prefer alcohol to kerosene, which, as the children know, smokes lamp-chimneys, or anything else, so easily.

We show a thermometer; the children are told its use if they are not already familiar with the instrument; we talk about the quicksilver in the tube, about its rising or falling according to the degree of heat or cold; then we inform the class that in

some countries where it is very cold quicksilver freezes ; for this reason alcohol, which does not freeze, is colored red and put into the thermometer tube to be used in these Arctic regions.

Another use for alcohol is to keep or preserve substances. This we illustrate by placing a piece of meat into some alcohol. We explain that the water in the meat is that which causes it to decay. Alcohol has the power to take up or *absorb* water ; so when meat is put into this liquid the water from the meat is absorbed by it, and the meat does not become bad. Those who wish to preserve insects a long time, and doctors who desire to keep any portion of a human body after death, put these into alcohol, in which they may be kept for a long time.

Lastly, we let the children smell cologne or other perfumery, and tell them this is made from different oils mixed with alcohol.

At the close of this lesson the class is ready to help us make the following

BLACKBOARD OUTLINE.

FACTS ABOUT ALCOHOL.

It melts gums.
Burns with a flame.
Burns without smoke.
Will not freeze.
Likes water.
Mixes with oils.

GOOD USES OF ALCOHOL.

To melt gums.
To make varnishes.
To burn in lamps.
To make camphene, etc.
To put into thermometer tubes.
To preserve meats, etc.
To make perfumery.
In making jewelry.

USES OF ALCOHOL—*concluded.*

You see alcohol is very useful for some purposes ; but do people ever drink it? Some of the children think not, and we grant that no one is foolish enough to drink *raw* alcohol, because it is too strong. It would take only a little to make them drunk, and only a few ounces to kill them instantly.

We ask the pupils if they have ever seen a drunken person, and what made that person drunk? We soon obtain an answer,

and place upon the board “Rum, gin, whiskey, brandy,” as the names of drinks which will take away the good sense of those who drink them. To these are added “Wine, beer, ale, lager, and cider.”

We explain that all these have alcohol in them, as may be known by smelling them, or by smelling the breath of those who have drunk even a little of them; and that because they contain alcohol they are called *alcoholic liquors*. If a person drinks any one of them he will be poisoned, more or less, according to how much he takes. The children are astonished at the word *poisoned*, but we explain that the very word, *intoxicated*, means poisoned. So a drunken man is a poisoned man. If enough alcohol, or alcoholic liquor, is drunk by any one, he will drop down dead as quickly as if he were shot by a cannon ball.

When told that alcohol is not a food, but a poison, the class readily understands what we mean, and we have no difficulty in having the following statements prepared and memorized:

FOOD.

That which makes the body grow, and helps to keep it alive.

POISON.

That which hurts the body, and makes it die.

ALCOHOL.

QUALITIES.

Water-like, *looks like water*.
 Transparent, *may be seen through clearly*.
 Odorous, *has a smell*.
 Pungent, *has a hot, biting taste*.
 Liquid, *will flow in drops*.
 Poisonous, *hurts the body*.
 Intoxicating, *takes away the senses; makes drunk*.
 Absorbent, *takes up or absorbs water*.
 Inflammable, *burns with a flame*.
 Uncongealable, *will not freeze*.
 Innutritious, *not good for food*.

GOOD USES.

To melt gums.
 To make varnishes.
 To burn in lamps.
 To make camphene, etc.
 To put in thermometer tubes.
 To preserve meats, insects, etc.
 To make perfumery.
 In making jewelry.

BAD USE.

To drink.

ABOUT FERMENTATION AND FERMENTED LIQUOR.

Alcohol. — Alcohol may be obtained from any substance which contains sugar or starch, or both sugar and starch, as apples, pears, grapes, potatoes, beets, rice, barley, maple, honey, etc.

Alcohol can be obtained only by *fermentation*. By fermentation we mean the change which takes place when a juice containing sugar decays, or goes to pieces. You know decay always makes things fall to pieces.

You ask, what pieces is sugar made of? Very, very little pieces, called *atoms*. There are different kinds of sugar. In that made from grapes, called *grape sugar*, there are six atoms of carbon, twelve of hydrogen, and six of oxygen. What are carbon, hydrogen, and oxygen? Oxygen is the kind of gas which keeps animals alive, and makes things burn. Hydrogen is another kind, which you have smelled perhaps when water has been spilled on a hot stove; the gas burned in street-lamps is hydrogen that has been driven out of coal. Carbon you see in charcoal and soot; the black lead of your lead-pencils is mostly composed of carbon and iron; lamp-black is pure carbon, without form or shape.

We will let these circles of colored paper stand for the atoms of carbon, hydrogen, and oxygen in grape sugar, — the largest, which are red, for the oxygen; the second size, which you notice are black, will represent atoms of carbon; while the little blue ones will make you think of hydrogen.

If you remember that it takes one atom of carbon and two of oxygen to make carbonic acid gas; also, that two atoms of carbon, one of oxygen, and six of hydrogen to form alcohol, you can easily find that two atoms of carbonic acid gas and two atoms of alcohol may be formed from an atom of sugar. So the more sugar a juice contains the more alcohol may be formed from it.

Cider. — Cider is made by pressing the juice out of apples. This sweet cider ferments, and the sugar part of it changes into carbonic acid gas and alcohol. People who do not understand this go on drinking cider, not knowing that it makes drunkards of those who drink much of a beverage which seems so pleasant and harmless.

Wines. — Wines are made from the juices of fruits which have sugar in them, especially grapes. Sometimes people have what they call *home-made wines*, which they make from blackberries, currants, elderberries, gooseberries, cherries, or other fruits. They may ask you to take some, saying, "This will do you no harm; we did not put any alcohol into it." They do not know what you have learned, that alcohol is always formed in decayed juices which contain sugar. It does not wait to be put into the home-made wines; it quietly comes in as they are getting made, at home or any other place, and will make people drunk as surely as when it is found in brandy or any other liquor.

Some of the wines in the stores are made from grape juice, but many more are made by mixing hurtful and poisonous things together to make the liquor strong, and give it what is called a fine color and good taste.

Beer and Ales. — These are made from grains and hops, which contain no sugar, it is true, but are composed of starch, which may be changed into sugar. When a seed of grain is put into the ground and begins to grow, the starch in it becomes sugar, which feeds the young plant. When a brewer wishes to make beer, he takes some grain, puts it in a dark place, wets it, and leaves it to sprout, or begin to grow. Then he puts it into an oven to dry it, and make it stop growing. This makes what is called *malt*. The malt is mashed and soaked in warm water to get the sugar out of it; this forms a liquid called *sweet wort*. The wort is separated from the mashed grain and boiled; yeast is mixed with it to help it to ferment more quickly; it soon becomes changed; a dirty yellow scum filled with bubbles comes to the top, which we know is the poisonous carbonic acid gas:

the other poison, alcohol, stays in the liquid and makes the beer taste good to those who like it.

Liquors made from grain are called *malt liquors*. Lager beer, and all kinds of ales and porters, are malt liquors. They make people dull, sluggish, and stupid who drink much of them. They do much mischief in the body, though it takes a larger quantity of any one of them to make a person drunk than it does of whiskey or brandy.

AN ATOM OF

GRAPE SUGAR.	CARBONIC ACID GAS.	ALCOHOL.
Carbon, 6 atoms.	Carbon, 1 atom.	Carbon, 2 atoms.
Oxygen, 6 atoms.	Oxygen, 2 atoms.	Oxygen, 1 atom.
Hydrogen, 12 atoms.		Hydrogen, 6 atoms.

DECAYED GRAPE SUGAR MAKES

2 atoms of carbonic acid gas and 2 atoms of alcohol.

ALCOHOLIC LIQUORS

MADE FROM

FRUITS.		GRAINS.
<i>Cider.</i>	<i>Wines.</i>	<i>Beer, Ales, etc.</i>
Apples.	Grapes,	Barley, Oats,
<i>Perry.</i>	Currants,	Wheat, Peas, etc.
Pears.	Blackberries, Cherries, etc.	Corn, (with hops).

DISTILLATION.

How does the sugar in grapes and other fruits become alcohol? — “By fermenting.” Yes, and liquors made by fermenting are called *fermented liquors*. What other alcoholic drinks have you heard about beside cider, wines, beer, and ales? — “Gin, whiskey, brandy, rum.” These are stronger than the fermented liquors, that is, they contain more alcohol; they are made by what is called *distillation*.

If you boil water, and let the steam from it fall upon a cold plate, the steam will change back into liquid and become

distilled water. Making a liquid boil, catching the vapor or steam and cooling it, is what we mean by distillation.

If two or more liquids are mixed together, the one that boils with the least heat will be drawn off first. The alcohol of beer, cider, and wines is mixed with water; it boils at a lower heat than water, so can be drawn off from it very easily. This does not make more alcohol, it only makes the alcohol stronger by separating it from the water.

When beer or any other alcoholic liquor is to be distilled, it is poured into a large copper boiler, called a *still*, and boiled. A tube carries the vapor from the boiler into a cask filled with cold water. This tube is coiled like a spiral line or worm through the cask; it is called *the worm of the still*, and the cask is *the worm-tub*. As the vapor passes through the tube, it cools and drops out at the end into the worm-tub, changed into a liquid stronger in alcohol than that from which it was drawn or distilled.

In this way gin is made from beer, brandy from wine, and rum from fermented molasses. These are very strong drinks, and only hard drinkers like them. But very few people begin by taking these; they first learn to like alcohol by drinking cider, beer, or wine, and end with gin, whiskey, or rum when they have become drunkards.

DEFINITIONS.

Distillation. Drawing the vapor from a boiling liquid and cooling it.

Still. Machinery for distilling; the boiler which holds the liquid.

The Worm of the Still. The tube which passes from the still to a cask, in which it coils like a worm.

Worm-tub. The cask which holds the tube or worm, and receives the distilled liquid.

Distilled Liquid. A liquid formed by cooled steam.

Distilled Liquors. Liquors made by distilling alcoholic liquors.

Fermented. Changed by decay.

Fermented Liquors. Liquors which have been fermented or changed by decay, and contain alcohol.

Unfermented. Not decayed.

Unfermented Liquors. Liquors which contain no alcohol.

KINDS OF LIQUORS

UNFERMENTED.		FERMENTED.	DISTILLED.
Grape juice,		Hard cider,	Gin,
Sweet cider,	Malt liquors {	Beer,	Brandy,
Root beer,		Lager beer,	Whiskey,
Ginger beer,		Ale,	Rum.
Perry.		Porter,	
		Wine.	

HARM DONE BY ALCOHOL

IN VARIOUS PARTS OF THE BODY.

RAW alcohol does not do much harm to people because it is too strong for them to drink much of it; but the alcohol hidden in cider, ale, wine, whiskey, and other alcoholic drinks kills not less than *sixty thousand* persons in this country every year, besides those who die from its use in other parts of the world.

There is great excitement when there is a mad dog around; and, if any one is bitten and dies from the dreadful hydrophobia, people are ready to destroy all the dogs of the neighborhood; but when a drunkard dies from delirium tremens or alcohol craziness, how few take any notice of the cause of his death, or do all they can to wage war against the use of alcoholic liquors.

But why do we say such hard things against these liquors which some people love so well and think so harmless? In what way do they hurt and kill people? Let us see. Where does what we drink go after it has been put into the mouth?—"Into the stomach." If it were the right thing to go into the stomach, into what would it be changed?—"Into something which helps to make good blood."

Learned men, who have examined and carefully studied about these things, tell us that *the stomach is hurt* by alcohol.

¹ These soon become fermented; they then contain alcohol.

because the fiery fluid is not food, but poison which makes the stomach very sore, and gives it hard work to do. The veins of the stomach take it up and send it into the liver. The liver, which is a large organ weighing about four pounds, lies on the right side below the lungs; its work is, to help make the blood pure. It can do nothing with alcohol, so it drives it along to the heart; the heart sends it to the lungs; the lungs throw some of it out through the breath, which smells of the vile stuff that has been poisoning every part it has passed through since it entered the mouth.

Some of the alcohol does not get out of the lungs through the breath, but goes with the blood back to the heart, and from the heart is sent through the arteries to every part of the body. No part of the body wants it.

The Skin drives some of it out, through its little pores, with the perspiration.

The Kidneys, which lie in the back below the waist, on each side of the spine, send off some of the poison.

Yet some of it gets into *the brain*, and there does very much mischief, of which you will learn more by and by. You know, if the brain is hurt, the mind cannot do its work of thinking properly; thus, alcohol does great *harm to the mind* through the brain.

The muscles and *the bones* are hurt by not being supplied with pure blood; *the heart* gets tired out with overwork, and *the lungs* become diseased through this same terrible alcohol.

Therefore, if you would be strong and healthy, have nothing to do with alcoholic liquors; for

ALCOHOL POISONS

The stomach,
The heart,
The bones,

The liver,
The lungs,
The muscles,

The blood,
The brain,
The skin,

And every part of the body.

IN THE STOMACH.

Children who have learned the Lesson on Digestion, and know about the coats of the stomach, about mastication and chyme-making, are easily made to understand why anything which has alcohol in it is unfit to go into the stomach.

If we touch a drop of alcohol to the eye, it will make it sore; so alcohol in the stomach irritates its coats and makes them sore.

Alcohol poisons the gastric juice. If we get some of this juice from the stomach of a calf which has just been killed, and mix alcohol with it, the alcohol will separate the watery part from the *pepsin* or white part. This is what alcohol does in the stomach. It takes up water from the gastric juice, which prevents the pepsin from mixing well with the food, and hinders the change of the food into chyme, which cannot take place without pepsin.

The children have already learned that alcohol keeps meat from decaying, or going to pieces. We explain that food in the stomach must go to pieces to prepare it to make blood; when mixed with alcohol, it is preserved, and the gastric juice cannot melt or dissolve it. Thus the stomach is hindered from doing its work until it gets rid of the alcohol.

A true story we have read will help you to remember how troublesome alcohol is to the stomach. Some men in Edinburgh were paid their wages, one Saturday, soon after they had eaten their dinner. They got drunk and remained so till the next day at noon. When they became sober they had a headache and were so ill that they sent for a doctor; he gave them some medicine which brought up their Saturday's dinner just as it had gone down into the stomach. The poor stomach could do nothing with dinner mixed with whiskey or rum, because these liquors are half alcohol.

You have already learned that the stomach hurries to drive out the alcohol into the liver; the liver sends it with the blood into the heart; the heart pours it into the lungs; the lungs breathe it out through the nose and mouth, and tell that some kind of alcoholic liquor has been taken into the stomach.

Remember, that the alcohol which comes out in the breath is a part of that which *went into the mouth*. It could not be changed. It did nothing but mischief in its journey, which shows that it is not food, but poison. God, who created the body, has not given any part of it power to change alcohol into blood.

People sometimes take ale or wine because they think it gives them an appetite. This is a great mistake. When any alcoholic liquor goes into the stomach, there is such hard work to get it out that the pain of hunger is not felt: when it is out, the stomach is tired and does not tell the brain that it is hungry. When alcohol is poured into it, day after day, it loses its desire for good, wholesome food, *and wants more and more alcoholic liquor*. It has an appetite for alcohol.

Alcohol makes the stomach sore and full of disease: people who take much of it in liquors always suffer much from dyspepsia.

So, if the stomach could speak, it would say: "Don't pour any alcohol into me, though you mix it and call it ale, cider, wine, or any other name that makes folks think it will do me no harm. You cannot deceive me. I know alcohol as soon as it comes down, and it always makes me suffer."

BLACKBOARD OUTLINE.

ALCOHOL —

- Burns or inflames the coats of the stomach.
- Spoils the gastric juice.
- Makes the food hard to be dissolved.
- Makes the stomach tired and weak.
- Takes away the appetite for wholesome food.
- Makes an appetite for alcoholic liquors.
- Causes disease in the stomach and other digestive organs.

QUESTION ON BLACKBOARD OUTLINE.

What harm does alcohol do in the stomach?

TO THE BONES, MUSCLES, AND SKIN.

To the Bones.— You have already learned that the bones require to be supplied with good blood to make them strong and healthy, and that alcohol does not make good blood, so we need spend no time in deciding that alcoholic liquors do injury to the bones, and that the bones of those who drink these liquors are less likely to heal, when broken, than those of persons whose blood has not been poisoned by alcohol.

To the Muscles.— The muscles, as you know, cover and move the bones ; good blood makes them grow, and keeps them healthy and strong. People like to have plenty of good muscle, for this not only gives them strength, but makes them look plump and well.

Alcohol poisons the blood by killing many of the very little, round, red parts in it, called by a long name, which you can learn if you try. This hard name is *corpuscles* [kor'pussls] ; *corpuscle* means a *little body*.

These little bodies float in the fluid portion of the blood, and go to every part of the body to help keep it alive and healthy. When alcohol hurts them, they turn into a poor kind of fat, like suet, and cannot do any good. They stay in different parts and do much harm. Sometimes they lodge between the muscles, and make a person look strong because plump ; but he is not strong, for his muscles are filled with fat.

Sometimes the liver or the heart, which are only large muscles, become so heavy and soft with fat that they cannot do their work properly ; they become weak and diseased, wear out, and cause the death of their owner, who has poisoned them with ale, wine, or other alcoholic drink.

To the Skin.— Alcohol hurts the skin also, by feeding it with poisoned blood, by giving the pores extra work in carrying off some of the alcohol in the perspiration, and by making the little blood-vessels larger than they should be in a way you will learn more about by and by. These little blood-vessels become very full of blood, and cause the red face and blue nose which

mark the drinker of alcoholic liquors. This redness of the skin tells of the mischief which alcohol is doing inside of the body. It is the danger-signal which warns against the use of the fiery poison.

ALCOHOL HURTS

THE BONES,	THE MUSCLES,	THE SKIN,
By supplying them with bad blood.	By supplying them with bad blood;	By supplying it with bad blood;
	By loading them with fat which makes them weak.	By over-working the perspiratory pores.

TO THE BLOOD, THE LUNGS, AND THE HEART.

To the Blood.—The wonderful fluid which is the life of the body consists of a water-like liquid in which floats millions of the very little, circle-shaped, red particles which you have been taught to call *corpuscles*. You have also been told that alcohol kills these little bodies, and thus takes some of the life out of the blood, and fills it with useless, suet-like fat.

The blood, you know, flows everywhere through the body, giving its goodness to make every part grow and live, and carrying away the worn-out particles it meets. Blood, when poisoned with alcohol, goes through the body, giving disease and death instead of health and life. So, if you want good, red blood, do not let alcohol get into it.

To the Heart.—When alcohol comes with the blood from the liver, the heart begins to beat fast to get rid of the fire-water; this makes it very tired, for it always has enough to do in carrying bad blood to the lungs, and pumping good blood into the arteries, without having the extra trouble of driving out alcohol. Wise people will not give it this extra work to do.

Besides, we told you, in the talk about the harm done by alcohol to the muscles, that the heart, — which is only a large

muscle, or rather many muscles fastened together so as to make a pear-shaped organ about the size of your fist, — is hurt in another way by alcohol. It gets too much of the poor kind of fat from the blood, which fills between the muscles, and after awhile makes the walls of the heart so soft and weak, that we could almost push through them with a finger, if we could get at them.

Very often the tired, overworked, weakened heart suddenly stops beating, and the person who would keep on drinking beer, wine, brandy, or rum falls down dead. “Died from heart disease,” people say, when the truth is, *died from drinking alcoholic liquors.*

To the Lungs.—What are the lungs?—“The breathing-machines of the body.” What do they throw out?—“Bad air.” What do they take in?—“Fresh air.” In pure air there is a good kind of gas which is necessary to keep us alive; this gas is called *oxygen*.

When air is taken into the lungs, the oxygen mixes with the blood in them and makes it pure. If alcohol is in the lungs, it hardens the walls of their air-cells, and keeps out the oxygen or good gas; at the same time it keeps in the impure gas, called *nitrogen*, which ought to come out through the nose and mouth into the air. Thus the blood in the lungs cannot be properly purified, and goes back to the heart impure blood which is unfit to be used.

The lungs are also obliged to work faster when alcohol is in them, because with the heart they are striving to drive out the enemy. This makes the lungs tired, sore, and inflamed. They are not as strong to do their work, and are more likely to breathe in any contagious disease than are the lungs of people who do not drink alcoholic liquors.

Some people go on drinking these poisons for many years, and seem not to be hurt by them; but at last they suffer from what is called Alcoholic Phthisis, a kind of consumption which doctors cannot cure.

HARM DONE BY ALCOHOL

TO THE

HEART.	BLOOD-VESSELS.	LUNGS.
Overworks it.	Hurries the blood through	Makes them work too
Makes it tired.	them.	fast.
Loads it with fat.	Stretches the small arteries	Heats and inflames
Softens and de-	and makes them unfit to	them.
stroys it.	work.	Hardens the walls of
	Poisons the blood in the	their air-cells.
	hair-like blood-vessels	Keeps in the poison-
	(capillaries).	ous gas.
		Keeps out the good
		gas (oxygen).
		Weakens them and
		makes them diseased.

THE BLOOD ("The life . . . is in the blood")

Consists of { A colorless liquid (plasma), and
 { Little, red, circle-shaped bodies (corpuscles).

ALCOHOL (a blood-poison)

Mixes with the colorless liquid, and takes away some of its goodness.

Makes some of the corpuscles { Smaller.
 { Change shape.
 { Lose color.
 { Lose oxygen.
 { Die, and change into useless fat.

TO THE BRAIN AND NERVES.

WHERE is your brain? — "In my skull." What color is it? — "Gray and white." What does it resemble? — "Marrow." What work is done in the brain? — "The work of thinking." You may repeat what you have learned about the membranes of the brain. (See Formula for the Lesson on the Nervous System.)

You say "the inner membrane is a net-work of blood-vessels." If these are blood-vessels in the membranes, what fills them?—"Blood." Do you think alcohol can get into the brain?—"Yes." How can it get there?—"It goes there with the blood." How can we know that alcohol does mischief in the brain? You cannot answer? Did you never see a drunken man? Now tell me how you might know his brain has been hurt by alcohol.—"He talks funny; he acts strangely; he is very cross; he does not know what he is doing; he walks crookedly; he falls down; sometimes he falls asleep, and is almost like a dead man; he is dead drunk."

Let us study to learn why the drunken man does such strange things. The alcohol in this bottle, and this egg which you see, will help us find the cause of the mischief. You may tell what is in the egg.—"A white liquid and a yellow liquid." How could they be made hard?—"By making the egg hot; by boiling." We will try what alcohol will do to the white part. You see when it is poured upon the white of the egg it hardens this part as boiling would harden it. This white portion is composed of water and something called *albumen*. The alcohol dries up the water and thickens the albumen.

Albumen is found not only in eggs but in some seeds, as beans, peas, corn, etc., also in the gray part of the brain and in the nerves.

We will talk first of the harm alcohol does to the nerves. You know they are the grayish-white cords which pass from the brain and the spine to every part of the body. What do they act like in the kind of work they do?—"Like telegraph wires." What is their work?—"To carry messages to and from the brain." What kinds of nerves have you learned about?—"Nerves of feeling and nerves of motion."

When alcohol touches a nerve, it draws away the moisture or water from it, and hardens the white part or albumen; this makes the nerve shrivel as if it had been burned; it loses its power to feel and move, or, to use a long word, is *paralyzed*.

Alcohol paralyzes all the nerves it touches. It makes them

so stupid that they cannot understand what the brain says to them, and they do not carry the right messages back to it. For instance: when the nerves of the stomach are poisoned by the alcohol in beer, wine, etc., they do not feel the pain of hunger as much as they otherwise would, and they let the brain think the stomach is satisfied and does not need any more food, when it is only stupefied by these liquors.

Again, it is the work of some nerves to tell the muscles of the small arteries to tighten, or contract, when too much blood is coming into them. Alcohol so paralyzes these nerves that they do not carry their message; the arteries let in the blood, and become swollen and enlarged. They tell the mischief done to them, by causing the skin to be red or flushed. If people drink much of any intoxicating liquor, and often, their skin is always a bad color, or, as grown folks say, becomes permanently discolored. All this because the nerves have been made unfit to do their duty by alcohol poison.

The nerves also lose power over the muscles of the limbs. This is plainly seen in the trembling of the hands and the unsteady walking of the drunkard; but is equally true of those who drink only a little now and then. Their nerves are not as strong and wide-awake to control the machinery of the body as they would be if no alcohol were troubling them.

Sometimes the nerves of hearing and sight tell the brain queer stories, and the poor brain believes them all, for it, too, is stupefied by the same fire-water which has hurt the nerves. Indeed, the harm done by alcohol to the brain is greater than that done to any other part of the body. It takes the water from the albumen, and makes the white part of the brain hard, as if it had been cooked. It kills the little, circle-shaped, red parts of the blood — the corpuscles; these collect in the blood-vessels of the brain, and keep the blood from flowing as fast as it ought, which causes disease and very often death. Sometimes the brain is so much injured by the poison that the drinker becomes crazy, and is a great deal of trouble to himself and everybody else.

Since all this is true, wise children will let cider, lager, ale, wine, and every other kind of alcoholic drink alone, and never, NEVER,

“Put an enemy into their mouths,
To steal away their brains.”

HARM DONE BY ALCOHOL

TO THE

NERVES.

Takes away their moisture, and paralyzes them.
Takes away their power to control the muscles.
Makes them unfit to carry messages to and from the brain.

BRAIN.

Fills or congests its blood-vessels with impure blood.
Collects in it, and paralyzes it.
Hardens its albumen.
So hurts it as to cause craziness (insanity) and death.

MORE ABOUT THE HARM DONE BY ALCOHOL.

In the lessons you have learned you have been taught about the harm done by alcohol to the body and the mind; can you tell, from what you have seen of drunken people, in what other way alcoholic liquors hurt them? — “They make people waste their money; they make them waste their time: they make them cross; they make them fight; they make them say silly and wicked words; they sometimes make fathers and mothers hurt their children; they make people lose their good name; they often make them do things for which they are sent to prison.”

Yes, this is only some of the mischief done by alcohol. If you could fly around the world and see everybody who has been hurt in any way by this terrible poison, what a sad, sad sight you would behold! At least half the trouble in the world comes from strong drink.

Are *you*, little girl, little boy, going to join the army of drunkards? No, indeed! you think; but probably no one who has become a drunkard ever intended to do so. They all began

with one glass, a few drops of some alcoholic liquor, — cider, wine, or beer perhaps, — and thus learned to love the taste of alcohol, and soon became its slaves. For this poison has the strange power of making those who drink it want more and more of itself, though they know it is doing them harm.

The only safety is in letting alcoholic liquors alone, forever.

BLACKBOARD OUTLINE.

ALCOHOLIC LIQUORS HURT

The body,
The mind, and
The soul ;

AND MAKE PEOPLE

WASTE	LOSE	UNFIT TO	UNFIT TO SERVE
Money,	Strength,	Think, or	Themselves,
Talents, and	Health, and	Work.	Their neighbor, or
Time.	Good name.		God.

STORIES ABOUT THE HARM DONE BY ALCOHOL.¹

A YOUNG BEGINNER. — The hardest drinker I ever knew commenced on cider when he was only five years old. He would go to the barrel of cider in the cellar, which had been put there to make vinegar, and, getting a straw, would suck all the cider he wanted; and then, after he had played awhile, he would go back and get more. He kept on drinking alcoholic liquors of some kind, until he died a drunkard.

CIDER DELIRIUM. — Dr. J. H. Travis, of Masonville, N.Y., was once called to a child six years old, who was raving in the wildest delirium. His symptoms were so peculiar that he questioned the family closely, and found that the day previous, at a raising, the child had drank freely of cider. After the men left he had procured a straw and gone to the barrel and drank till he was senseless, and after this the delirium

¹ From *Juvenile Temperance Manual*, by Julia Colman.

came on. He exhibited undoubted symptoms of delirium tremens. Cider was the common beverage of the family. Dr. Travis has been called to several other cases of delirium tremens from the use of cider. — *Mrs. E. J. Richmond.*

A CAUTION TO MOTHERS. — One of the first literary men in the United States said to a temperance lecturer: "There is one thing which I wish you to do everywhere; entreat every mother never to give a drop of strong drink to a child. I have had to fight as for my life all my days to keep from dying a drunkard, because I was fed with spirits when a child. I thus acquired an appetite for it. My brother, poor fellow, died a drunkard."

A GIRL DRUNKARD. — A young girl of eighteen, beautiful, intelligent, and temperate, the pride of her home, was recommended to take a little gin for some chronic ailment. She took it; it soothed the pain; she kept on taking it; it created an artificial appetite, and in four years she died a drunkard. — *Medical Temperance Journal.*

"A LITTLE WON'T HURT HIM." — I was the pet of the family. Before I could well walk I was treated to the sweet from the bottom of my father's glass. My dear mother would gently chide with him, "Don't, John, it will do him harm." To this he would smilingly reply, "This little sup won't hurt him." When I became a school-boy I was ill at times, and my mother would pour for me a glass of wine from the decanter. At first I did not like it; but, as I was told that it would make me strong, I got to like it. When I became an apprentice, I reasoned thus: "My parents told me that these drinks are good, and I cannot get them except at the public-house." Step by step I fell. . . . I have grown to manhood, but my course of intemperance has added sin to sin. My days are now nearly ended. Hope for the future I have none. — *Dying Drunkard.*

DANGER. — In one of Mr. Moody's temperance prayer meetings at Chicago, a reformed man attributed a former relapse of drunkenness wholly to a physician's prescription to take whiskey three times a day!

KILLED BY THE POISON. — Many years ago, when stage coaches were in use in England, during a very cold night, a young woman mounted the coach. A respectable tradesman sitting there asked her what induced her to travel on such a night, when she replied that she was going to the bedside of her mother, of whose illness she had just heard. She was soon wrapped in such coats, etc., as the passengers could spare, and when they stopped the tradesman procured her some

brandy. She declined it at first, saying she had never drank spirits in her life. But he said, "Drink it down; it won't hurt you on such a bitter night." This was done repeatedly, until the poor girl fell fast asleep, and when they arrived in London she could not be roused. She was stiff and cold in death, and the doctor, on the coroner's inquest, said that she had been killed by the brandy. — *Mrs. Balfour.*

IN CASE OF SHIPWRECK. — In the winter of 1796 a vessel was wrecked on an island of the Massachusetts coast, and five persons on board determined to swim ashore. Four of them drank freely of spirits to keep up their strength, but the fifth would drink none. One was drowned, and all that drank spirits failed and stopped, and froze one after another, the man that drank none being the only one that reached the house at some distance from the shore, and he lived many years after that.

IT EXHAUSTS STRENGTH. — Concerning one cold winter when there were very severe snow-storms in the Highlands of Scotland, James Hogg, the poet, says: "It was a received opinion all over the country that sundry lives were lost, and a great many more endangered, by the administration of ardent spirits to the sufferers *while in a state of exhaustion*. A little bread and sweet milk, or even bread and cold water, proved a much safer restorative in the fields. Some who took a glass of spirits that night never spoke another word, even though they were continuing to walk and converse when their friends joined them. One woman found her husband lying in a state of insensibility; she had only sweet milk and oatmeal cake to give him, but with these she succeeded in getting him home and saving him" — *Bacchus.*

SHIPMASTER OF THE KEDRON. — "I was brought up in a temperance school, and when I shipped before the mast I stuck to my principles, though everyone else on board drank excepting two boys whom I persuaded to abstain. In a very severe storm off a lee-shore, when it was so cold they had to break the icicles off the ropes to tack the ship, all drank but myself and these two boys. The men would work very well for a few minutes, and then slack off and take another drink, until they were all keeled up, and we three boys had all we could do to keep the ship from going ashore. If we had drank with the rest, all would have been lost, for the men were too drunk to save themselves. Providentially, the storm abated before morning, and we were saved. Now, for many years I have been captain of my own ship, and I never give out one drop of liquor." — *Captain Brown.*

ON THE PLAINS. — Twenty-six men, travelling on one of the great Western plains in the United States, were overtaken by cold and night. They had food, clothing, and whiskey, but no fire. They were warned not to drink whiskey or they would freeze. Three did not drink a drop, and though they felt cold they did not suffer nor freeze. Three more drank a little, and though they suffered much they did not freeze. Seven others that drank a good deal had their toes and fingers frozen. Six that drank pretty strong were badly frozen and never got over it. Four that got very boozy were frozen so badly that they died three or four weeks afterward. Three that got dead drunk were stiff dead by daylight. They all suffered just in proportion to the amount of whiskey they took. They were all strong men, and had about the same amount of clothing and blankets; the whiskey was all that made the difference.

THE RED RIVER EXPEDITION in Canada, in 1870, is often quoted as one of the most laborious on record, 1200 troops travelling 1200 miles through a very dense wilderness, and having all their supplies to carry. They were ninety-four days out, and none of them had liquor. They were constantly wet through, sometimes for days together, and all the while at the severe labor of rowing, poling, tracking, and portaging, yet they were always well and cheery, and there was a total absence of crime.

IN AFRICA it is far safer to do without intoxicating drink. Livingstone says that he lived without it for twenty years. Stanley performed his wonderful journey without it. Bruce said more than one hundred years ago: "I laid down as a positive rule of health that spirits and all fermented liquors should be regarded as poisonous. Spring, or running water, if you can find it, is to be your only drink."

WATERTON, the great naturalist, who travelled so much in South America, says: "I eat moderately, and never drink wine, spirits, or any fermented liquors in any climate. This abstemiousness has proved a faithful friend." He died by accident at the age of eighty-three.

MR. HUBER, who saw 2160 perish of cholera in twenty-five days in one town in Russia, says that "Persons given to drinking are swept away like flies. In Tiflis, containing 20,000 inhabitants, every drunkard has fallen." Of 204 cases of cholera in the Park Hospital, New York, there were but six temperate persons, and these recovered. In Albany, where cholera prevailed with severe mortality for several weeks, only two of the 5000 members of temperance societies became its victims.

In Montreal, where the victims of the disease were intemperate, it usually cut them off. In Great Britain, those who have been addicted to spirituous liquors and irregular habits have been the greatest sufferers from cholera. In some towns the drunkards are all dead. — *Bacchus*.

THE RUMSELLER NOT A GOOD CITIZEN. — A liquor dealer was tried for some crime, convicted, and sentenced by the judge. Some friends, in a subsequent plea, said that he was a worthy man and a good citizen. "A worthy man," said the judge, "and make drunkards! A good citizen, and fill up our jails and almshouses, and cause men to commit murder and every iniquity! No, sir. Your request must be denied."

PRESIDENT LINCOLN'S MURDERER. — When Wilkes Booth had made up his mind to kill President Lincoln, he could not muster the courage to execute his plan without the aid of brandy. He went to the bar and called for "Brandy! brandy!" and then sought his victim, and did his bloody deed.

WIFE MURDER. — A mechanic in New York city told me that when he had partaken freely, and was at home, he felt an almost superhuman desire to kill his wife. He loved her dearly as any man could, but several times while intoxicated he had caught himself with weapons in his hands preparing to take her life. He feared that he might some day commit the crime before he was aware of it. — *Story*.



STORIES ABOUT THE RIGHT WAY TO TREAT ALE, BEER, Etc.

THE RIGHT SIDE. — "Boys, which is the right side of the public house? Can you tell me?" — "Yes, sir, the outside."

THE GOAT AND THE ALE. — Many years ago, when everybody drank freely, a Welsh minister named Rees Pritchard was at the ale-house drinking, when he took it into his head to offer some ale to a large tame goat. The animal drank till he fell down drunk, and the minister drank on till he was carried home drunk. The next day he was sick all day, but on the third day he went again to the ale-house, and began to drink. The goat was there, and he offered him more ale, but the

animal would not touch it. The minister, seeing the animal wiser than himself, was ashamed, and gave up drinking, and became a worthy minister.

HOW THE MONKEY WAS CURED. — A monkey named Kees had been taught to drink brandy. At dinner every day he had his share like his more manly (?) neighbors, only that his was given to him in a plate. One day, as he was about to drink it, his master set it on fire, and he ran off frightened and chattering. No inducement could afterward make him drink brandy. We have many stories of animals who would never drink again after they had once experienced its effects.

THE KEEN MARKSMAN does not poison his nerves and brain with alcohol. Angus Cameron, a Highlander, at the age of twenty, took the Queen's prize for the best marksmanship, and when he was twenty-two (in 1869), he won in the same way a cup worth \$1000. He made the best shot each time that ever had been made in the contest, and neither of them has been beaten by anyone else. Angus is a slight, modest, unassuming young man, who had been a Band of Hope boy. When he was announced as the winner, and all the friends made an ado over him, and offered him a generous glass of champagne, he quietly refused their mistaken kindness, and kept his pledge.

BENJAMIN FRANKLIN, when a printer boy in London, would drink no beer, and his companions called him the water American, and wondered that he was stronger than they who drank beer. His companion at the press drank six pints of beer every day, and had it to pay for. He was not only saved the expense, but he was stronger than they, and better off in every way. If he had gone to drinking beer at that time, like the other printer boys, it is likely we should never have heard of him.

OATMEAL DRINK. — "In Boulton and Watts' factory we saw an immense workman at the hottest and heaviest work, wielding a ponderous hammer, and asked him what liquor he drank. He replied by pointing to an immense vessel filled with water and oatmeal, to which the men went and drank as much as they liked." This is made by adding one pound fine oatmeal to each gallon of water, and is much used in factories and at heavy work of all kinds in Government works, instead of the old rations of alcoholic liquors. Iron puddlers, glass blowers, and athletic trainers, all do their work now better without alcoholic liquors.

A CHANGE IN AFFAIRS.—A poor boy was once put as an apprentice to a mechanic; and, as he was the youngest, he was obliged to go for beer for the older apprentices, though he never drank it. In vain they teased and taunted him to induce him to drink; he never touched it. Now there is a great change. Every one of those older apprentices became a drunkard, while this temperance boy has become a master, and has more than a hundred men in his employ. So much for total abstinence.

BOOKS BETTER THAN BEER.—An intelligent young mechanic stood up in a temperance meeting and said: "I have a rich treat every night among my books. I saved my beer money and spent it in books. They cost me, with my book-case, nearly \$100. They furnish enjoyment for my winter evenings, and have enabled me, by God's blessing, to gain much useful knowledge, such as pots and pipes could never have given me."

A LITTLE DRUMMER-BOY was a favorite among the officers, who one day offered him a glass of strong drink. He refused it, saying that he was a Cadet of Temperance. They accused him of being afraid; but that did not move him. Then the major commanded him to drink, saying: "You know it is death to disobey orders." The little fellow stood up at his full height, and fixing his clear blue eyes on the face of the officer, he said: "When I entered the army I promised my mother on bended knees that, by the help of God, I would not taste a drop of rum, and I mean to keep my promise. I am sorry to disobey orders, sir, but I would rather suffer than disgrace my mother, and break my temperance pledge." He was excused from drinking.

APPENDIX II.

TOBACCO.

TOBACCO.

INTRODUCTORY LESSON.

You have been learning about the poison alcohol, and what mischief is done by it; we will now study about another poison which thousands of persons are using every day. It is rolled in cigars and cigarettes, and hidden in snuff and pieces of tobacco, and does more harm to children and young people who use these things than to grown persons.

Perhaps you know how a person feels who takes tobacco or smokes a cigar for the first time; if not, we will tell you. He begins to be dizzy, to tremble, to become faint, and to vomit; his head aches, and he is so sick for hours, often for several days, that he scarcely knows what to do. Why is he so sick? Because tobacco poison has been taken into his lungs; also, some has mixed with the saliva and gone down into his stomach; and each part it has reached is striving to drive it out, and is saying, by the pain it causes, "You have given me poison; do not give me any more." If he had taken enough it would have killed him.

He recovers from this sickness and tries chewing or smoking again and again, until he becomes accustomed to the poison and can chew or smoke and it does not hurt him; so he thinks, but he is very much mistaken.

Tobacco is a poison, and hurts everybody who uses it every time they do so, although it does its evil work very slowly, unless taken in large quantities. To understand more about this we will try to learn how tobacco is obtained, what poison is in it, and in what way it harms people.

THE STORY ABOUT TOBACCO.

How it Came to be Used.—Tobacco is the leaves of the tobacco plant, a native of America. It was used by the Indians of this country before Columbus came here in 1492. Some of the Spaniards who were with him on his second visit took some of it back with them to Portugal, and told the people they had discovered a wonderful medicine. From Spain tobacco seed was sent to France by Jean Nicot, in 1560. It is said that Sir Walter Raleigh carried it to England in 1586, when Elizabeth was queen.

In a few years many civilized people were snuffing, chewing, and smoking tobacco, like the wild Indians, although it cost them a great deal of money to do so. King James does not seem to have liked it very much, for he said, "It is a custome loathsome to the eye, hateful to the nose, harmful to the brain, and dangerous to the lungs." He called the smoke "stinking fumes."

The Tobacco Plant.—This plant belongs to the same family as the deadly nightshade, henbane, belladonna, thorn-apple, Jerusalem cherry, potato, tomato, egg-plant, cayenne pepper, bitter-sweet, and petunia. Most of the plants of this Nightshade family have more or less poison in their leaves or fruit. Tobacco is supposed to have been named from the pipe used by the Indians in smoking its leaves.

The common tobacco plant grows from three to six feet high, and has large, almost lance-shaped, leaves growing down the stems; its flowers are funnel-shaped and of a purplish color. When fresh the leaves have very little odor or taste.

How Tobacco is Used.—When the plants are ripe, they are cut off above the roots and placed where they will become dry, sometimes in a building made for this purpose, called "a tobacco house." After a short time they begin to smell strong and taste bitter. They are then stripped from the stems very carefully and sorted. The leaves nearest the root are considered the poorest, those at the top generally the best.

The different sorts are packed in separate hogsheads, and sent away to be sold to manufacturers of cigars, snuff, etc.

The manufacturer has some leaves rolled into cigars, some pressed into cakes for chewing, or into little pieces to be smoked in a pipe; while some are ground for snuff. While the dried leaves are being rolled, pressed, or ground, various substances are mixed with them to give them an agreeable odor and pleasant taste.

Yet, however pleasant the manufacturer may make them as he rolls, presses, or grinds, he cannot take the poison out of them. It remains in its brown covering to do much harm to those who may smoke the cigars, use the snuff, or chew the tobacco.

BLACKBOARD OUTLINE.

THE TOBACCO PLANT.

NATIVE OF	FOUND BY	TAKEN TO	GROWS IN THE
America.	Columbus, 1492.	Portugal, 1496. France, 1560. England, 1586.	Torrid and temperate zones.
(About 50 species.)			

DESCRIPTION.

Height, 3 to 6 feet.

Leaves, lance-ovate, and running down the stem.

Stem, hairy and sticky.

Flowers, funnel-shaped and purplish.

FAMILY.

The same as the Jerusalem Cherry.

Petunia,

Potato,

Tomato,

Egg-plant,

Red pepper, etc.

HOW MADE READY FOR USE.

(1)

Cut-off above the roots.

Dried.

Stripped; sorted.

Packed, and sold to the manufacturers.

(2)

Flavored and scented.

Rolled for cigars.

Pressed for chewing.

Ground for snuff.

THE POISON IN TOBACCO AND THE HARM IT DOES.

The Poison.—What is the poison in fermented liquors?—“Alcohol.” In distilled liquors?—“Alcohol.” True; and the strongest poison in tobacco is *nicotine*, named from the man who first sent it to France, Jean Nicot. Beside this it contains several others, some of which we shall tell you about when we make up our blackboard outline.

Tobacco, like alcohol, is a narcotic; that is, it soothes pain and produces sleep. Alcohol acts first upon the nerves; tobacco upon the muscles, which it weakens and causes to tremble. It often causes palpitation of the heart.

If the skin is scratched or punctured, and tobacco poison put into the wound, it will do the same harm as if it were taken into the stomach. Tobacco is so dangerous that physicians do not use it much as a medicine.

Harm done in the Stomach.—You remember that after alcohol has been swallowed, the little mouths of the stomach take it up and carry it to the liver, which sends it with the blood to different parts of the body.

Tobacco, as we have already told you, poisons more slowly. People do not swallow it purposely, yet some of it goes down, accidentally, into the stomach with the saliva, and makes trouble there, causing nausea and vomiting when taken for the first time. By and by the stomach seems to take the poison without being hurt, but it really suffers from dyspepsia or other diseases, and often loses its appetite for wholesome food.

Harm done in the Mouth, Throat, and Lungs.—The mouth takes in some of the poison through the pores of the membrane, or skin, which lines it; those who smoke, sometimes have what is called “smokers’ sore throat”; besides this, the senses of taste and smell are more or less injured by nicotine and the other poisons in tobacco.

The fumes, or smoke, from the weed fills the air with poison-

ous vapor which irritates the lungs, not only of the smoker, but of all who are where they must breathe the same atmosphere. Lungs thus irritated are liable to become diseased.

Cigarettes are still more injurious than cigars because of the smoke from their paper coverings; also, because from the way they are made, more of the tobacco poison goes into the lungs. The cheap cigarette which boys use is made from cast-away cigar stumps and other filthy things.

Harm done in the Brain and Nerves.—The smoker feels so rested and comfortable, after his cigar, and his brain is so rested, that he does not think about the mischief that is going on among its blood-vessels and nerves; perhaps he has never heard that tobacco, snuffed, chewed, or smoked hurts the brain, and does not learn about it until he finds he is losing his memory, that his mind is not so strong to think as it should be, and his will too weak to help him conquer his love for the snuff, tobacco, or cigar, when he wishes to stop using it. He has become the slave of tobacco, and it is not easy to get free from his cruel enemy.

The nerves also lose their power, or become more or less paralyzed by nicotine and the other tobacco poisons.

More about the Harm done by Tobacco.—Some persons who continue to use tobacco are strong enough to throw off the poison through the lungs, the skin, and in other ways; but how much better it would be if they were not obliged to employ their strength in getting rid of that which does them no good, which only gives a little pleasure to nobody but themselves, and often makes those suffer who are compelled to remain where they are having “a good smoke.” Beside, their breath and clothing have the tobacco odor, which not only makes the air impure, but is disagreeable to most people.

If this be true of smoking, what shall we say about the filthy habit of chewing, and the utterly useless and disgusting practice of taking snuff, which injures the voice as well as the senses of taste and smell?

And what about spitting tobacco juice on the floors of cars, steamboats, churches, — any place where it is convenient for the man or boy who has lost his common politeness in his love for tobacco?

We must not forget that cigars, etc., cost money. No one who smokes, chews, or snuffs would throw away dollars and cents which might be put into the savings bank, or used in buying something worth having for himself or somebody else.

Lastly, we would have you know that tobacco causes thirst, and this often leads to drinking alcoholic liquors. Some one who has studied this subject, says that "nine out of ten of the boys and young men who become drunkards have first learned to smoke or chew tobacco." A New York daily paper gave a list of 294 cases of insanity caused by drinking, in 246 of which the whiskey drinking followed tobacco chewing.

Tobacco and alcohol make thousands of wretched homes, and send a great many people to prison or to the insane asylum; so we entreat you to turn from beer, wine, and all alcoholic liquors as you would from a serpent, and say No, when tempted to smoke a cigar or use tobacco in any form.

Do this all the more decidedly because, as we have told you before, alcohol and tobacco hurt children and young persons in every way more than they injure any one else. If you have begun to use these poisons, give them up this very day, before the habit of using them becomes too strong for you to break.

QUESTIONS ON THE USE OF TOBACCO.

Of what poison beside alcohol have you been studying? — "Tobacco."

How is tobacco used? — "Some take it in snuff; some chew it; some smoke it in a pipe; some smoke it in cigars or cigarettes."

What is the name of the strongest poison in tobacco? — "Nicotine."

What harm does tobacco poison do to the body? — See Blackboard Outline.

What harm does it do to the mind? — See Blackboard Outline.

Whom does it harm most? — "Those who begin to use it when they are children or very young."

What happens to children or young people if they use tobacco in any way?

— "They are not healthy; they are not strong; they do not grow fast; they look pale and sickly."

How does the tobacco poison hurt their minds? — “They cannot learn fast; they often forget what they have learned.”

What often makes tobacco-chewers, snuffers, and smokers disagreeable to clean people? — “Their breath smells of tobacco; their clothes smell of tobacco; they poison the air with tobacco-fumes; some have the filthy habit of spitting tobacco-juice wherever they happen to be.”

What other harm does the use of tobacco do to people? — “It makes them waste time and money; it leads some to drink alcoholic liquors and to go with bad company.”

If you are wise how will you treat tobacco? — “I will let it alone.”

If you have begun to use it what had you better do? — “Give it up to-day.”

Why to-day? — “Because the longer I use it the harder it will be for me to give it up.”

If you keep on using it what will you be? — “A tobacco slave.”

BLACKBOARD OUTLINE.

TOBACCO.

POISONS IN TOBACCO.	SMOKE. EFFECTS OF THE POISONS.
Carbonic acid	Causes sleepiness and headache.
Carbonic oxide	{ Causes trembling of the muscles and heart.
Ammonia	
Nicotine	{ Bites the tongue; makes too much work for the salivary glands.
	See below.

NICOTINE

IS	CAUSES
Odorous,	Weakness,
Pungent,	Nervousness,
Emetic,	Dizziness,
Poisonous,	Nausea,
Pain-soothing,	Faintness,
Sleep-producing, <i>i.e.</i> Narcotic.	Loss of strength,
	Stupor,
	<i>If taken in large quantities, Convulsions and Death.</i>

SOME OF THE HARM DONE BY TOBACCO

TO THE BODY.	TO THE MIND, ETC.
Poisons the saliva.	Makes the memory poor.
Injures the sense of smell, taste, sight, and hearing.	Lessens the power to think.
Causes "smokers' sore-throat."	Weakens the will.
Injures the stomach, causing dys- pepsia, etc.	Makes people grow in selfishness and impoliteness.
Often takes away the appetite for wholesome food.	Makes people waste time and money.
Irritates the air-cells of the lungs.	Often leads to drunkenness and bad company.
Causes palpitation of the heart.	Sometimes causes insanity.
Weakens the muscles, causing trembling. Injures the eyes.	
Excites, then stupefies and para- lyzes the brain and the nerves.	

OPIUM AND OTHER NARCOTICS.

Opium. — Opium is the juice obtained from the seed-vessels of the white poppy before they are ripe; this is dried, and smoked in a pipe or chewed. It makes a person feel very pleasant and happy for a little while, then so horribly wretched that he takes more of the poison to forget his misery. So he keeps on until mind and body are a complete wreck. Now and then an opium slave gets free from the dreadful habit which has mastered him, but usually the slavery ends only in death.

Laudanum and Morphine. — These soothe pain and cause sleep; but beware of them; they are made from opium, and like it, though more slowly, hurt mind and body.

Beware also of *chloral hydrate* and *chloroform*, which physicians give to ease suffering and produce sleep. *Endure pain* rather than form the habit of using these narcotics.

Hashish, etc. — This is prepared from the hemp plant growing in hot countries, and is a terribly exciting poison.

The *areca nut*, the seed from a kind of palm, pear-shaped, and resembling a nutmeg, is mixed with quick-lime and wrapped in a betel-leaf, which grows on a vine belonging to the pepper family. This mixture reddens the saliva and lips, and blackens the teeth. It is chewed by millions of people in India.

The leaves of the *coca*, also of the *thorn apple*, are smoked or chewed by the South American Indian.

All these poisons mean the same thing, —

A little pleasure, DISEASE, and DEATH.

Press of
Berwick & Smith,
Boston.

QT B92p 1884

61250250R



NLM 05046176 6

NATIONAL LIBRARY OF MEDICINE